

AMERICAN AIR SERVICE OBSERVATION IN WORLD WAR I

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FOREWORD

A knowledge of enemy strength and activity has always been essential to the formulation and execution of successful plans for military operations. After centuries of war in Europe cavalry reconnaissance evolved as the principal means of obtaining this strategic intelligence. It was always a difficult mission to perform and became even more arduous after the rise of mass armies and the increase of fire power at the time of the French Revolution.

By a curious coincidence, man-carrying balloons appeared during the era of the French Revolution. Military leaders, conscious of the importance but mindful of the difficulty of obtaining satisfactory reconnaissance, initially hailed these remarkable spheres as the solution to their problem. The experience of military aeronautics in the following century revealed, however, that balloon detachments lacked the mobility necessary to participate in the war of movement. A contempt for the technique of aerial observation developed among general staffs because of conspicuously inaccurate reports from aeronauts who were often free-lance adventurers with more courage than training or knowledge in military science. Interest in aerial surveillance waned and in most armies balloons were subordinated to the use of cavalry reconnaissance.

Failing to dissolve the fog of war, commanders sought some system which would insure victory in spite of their blindness. This

was the basis for the doctrine of the offensive à outrance--the headlong offensive. It was a simple and attractive formula: a determined advance at all costs to impose a commander's will on the enemy, making the latter's movement of little importance. This doctrine lessened the army's dependence on its reconnaissance branches such as the cavalry or aeronautics.

The soldiers that settled into the trenches of western Europe after a few disastrous months of open warfare in 1914 were the victims of the attempt to wage the offensive à outrance with massed armies and devastating fire power. The awful results of this fighting have become familiar to us all. The poverty of their strategic doctrine was clearly demonstrated to the generals on both sides and the following years of the war were spent in a halting search for weapons and techniques of achieving victory. Machine guns, poison gas, and tanks were some of the developments in land warfare. On the sea, the submarine proved to be an extremely effective weapon. Even the air became a battleground in World War I.

This study presents a detailed narrative and analysis of one of the aspects of aerial warfare which the United States Air Service performed during World War I--observation aviation. While bombardment and pursuit aviation of the American Expeditionary Forces caught the public fancy and subsequently have received substantial amplification by "air power" enthusiasts, it was the use of airplanes for liaison purposes and for close-support observation and reconnaissance that was the most significant in terms of achievement. This achievement, albeit

limited in time and scope, has often been overlooked and deprecated in an effort to substantiate arguments of "Air Force" versus "Army" or tactical (fighter) versus strategic (bombardment) aviation doctrines. This study is a consideration of the "Air Service" concept of World War I. It does not attempt to present a case for or against the "Air Force" concept which maintains that military aviation should be a separate, independent, and co-equal establishment.

While lengthy considerations of present developments in aerial reconnaissance such as were highlighted by the American U 2 incident of May, 1960, may be difficult, a study of aerial observation during the war when it was first significantly effective may be of interest and value. In an age when supersonic speeds are limiting further progress in fighter aviation and when guided missiles are threatening to replace piloted bombers, perhaps the study of observation--one of the original goals of man's quest for flight--is not without purpose.

The author has not dealt with all phases of America's military aviation effort in World War I. The Navy's achievement in the air is beyond the scope of this study. The Lafayette Escadrille, that colorful band of American adventurers who, along with French aviators fought the Germans in the skies of western Europe even before the United States entered the war, made little contribution to the development of American aerial observation during World War I. Also omitted are the activities of the Americans who served in pursuit or bombardment organizations with the British Royal Air Force or the Italian Air Service. This work is not simply a chronicle of United States Army aviation units. Although Air Service organizations are mentioned

from time to time, their function in the narrative which follows is to distinguish the activities of the men who served in them. Indeed, the focus of this study lies in the role played by aerial observation in shaping the developments of the war.

It is a premise of this work that observation was the motivation for the first employment of airplanes and that in World War I other branches of aviation grew from this central theme. Pursuit and bombardment aviation were never so completely separated from observation as to discontinue performing reconnaissances while carrying out their specialized assignments. While most of the narrative is concerned with the operations of observation squadrons the activities of these other units as well as those of balloon companies is also presented.

The writer has tried to make his narrative intelligible to those who, like himself, are outsiders to military aviation. The overly technical and obscure dialect of military aviation has been avoided as much as possible. Changes of rank and assignment were rapid during the war, so that the prefixes to officers' names varied from month to month. When describing a particular event, the rank held at the time has been given. When speaking more generally, the highest rank attained by the individual is used.

Perhaps no two writers would make the same choice of events or of chronological limits in telling this story. Primarily concerned with a well-knit and comprehensive account, I have chosen to begin with the development of aerial observation prior to the entry of the United States into World War I. In describing this experience it seemed

worthwhile to carry the narrative back briefly to the evolution of aircraft. In several instances, when it was felt that such an analysis would contribute to a better understanding of the central theme, considerable detail has been lavished upon the discovery of a particular technique. Oftentimes, on the other hand, developments that do not reveal the basic trends in aviation have been omitted or referred to only in passing. If pursuit and bombardment developments appear neglected, it is because this study is not intended as an exhaustive account of all types of aerial activity, and throughout such activities have been relegated to their proper relationship to observation operations.

This study is an attempt to tell the story of the tool of aerial observation used in World War I. For a fuller comprehension of the subject it seeks to explain the development of the means and doctrine of observation aviation prior to and during this conflict. Throughout the countless millenia in which men have implemented their unfriendly impulses, military intelligence has been of decisive importance in making command decisions of strategy and tactics. Without minimizing other important factors affecting warfare, such as morale and logistics, a disregard for the intelligence aspect of the art of war might lead to disaster.

With this much in the nature of explanation I must nevertheless confess a sense of inadequacy. In so vast and complex a field, this work must be regarded in the nature of an experiment. Despite intensive reading in the source materials and representative works it would not have been possible for me to undertake this study had I not

been unusually fortunate in securing the assistance of many people.

I am under especially heavy obligation to Dr. John K. Mahon, who served as chairman of my supervisory committee and guided this study. To Dr. Franklin A. Doty, Dr. Frederick H. Hartmann, Dr. Rembert W. Patrick, Dr. Samuel Proctor, and Dr. Oscar Svarlien, I wish to express my appreciation for their help in the preparation of this dissertation. Their scholarly advice has been an encouragement throughout my studies and they have contributed to the solution of many of the difficult problems involved in this work.

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To the staff of the Air University Library go sincere thanks for a multitude of services. Mr. John Cameron saw to my repeated requests for books. Recognition for assistance is also due Dr. Robert Krauskopf and the archivists in the World War I Branch, War Records Division of the National Archives and Records Service.

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PART I

AERIAL OBSERVATION PRIOR TO THE ENTRY OF THE UNITED STATES
INTO WORLD WAR I

CHAPTER I

DEVELOPMENT OF BALLOONS AND AIRPLANES

Introduction

Shortly after noon on July 22, 1812, a British general, Sir Arthur Wellesley, not yet the Duke of Wellington, stood with members of his staff on a windy hill near Salamanca, Spain. He was munching on a chicken leg and glancing now and then through a telescope at the army of his French adversary, Napoleon's illustrious Marshal Auguste de Marmont, manuevering on the plain below as Wellington later wrote, "in the usual French style, nobody knew with what object." Marshal Marmont was unwittingly marching his army across the front of Wellesley's entire command. Behind the crest on which the British staff stood, and hidden from the French, were three divisions waiting for the order to emerge and pounce upon their unsuspecting enemy.

General Wellesley was quite pleased with the situation on this particular afternoon and glowed with the first warm food that he had had in several days, for his army had been following the French so closely that there had been no opportunity for cooked rations. He turned to one of the Spanish officers on his staff, and, after noting the importance of a general's knowing what the enemy on the other side of the hill is doing, cheerfully concluded: "Mon cher Alava . . . Marmont est perdu." Tossing his chicken bone over his shoulder,

Wellesley mounted his horse and galloped off to give his attack order to his brother-in-law, Sir Edward Packenham. (It was this same Packenham who, three years later, leading veterans of this day near Salamanca against Andrew Jackson's militia, met his death in the swamps south of New Orleans.) Packenham's attack, launched from behind the hill, struck Marmont with such force that the French were badly defeated and the power of Napoleon destroyed in Spain. Marmont had not known what was on the other side of the hill.¹

Wellington's remark to Alava is, however, by no means the earliest recorded statement of a great military leader regarding the desirability of knowing the situation beyond the horizon. Down through the centuries soldiers have been concerned with gaining high ground from which they might observe the actions of their enemy, and on the basis of this intelligence develop plans for action. Chiefs and generals climbed trees, or mountains, or hung precariously on rooftops to gain vantage points. When they grew too old, or fat, or too covered with honors to perform observations themselves, they delegated this task to their more agile lieutenants. They continued to seek new and better ways to look down on their foes. In Caesar's War Commentaries the author often digresses to mention the occupation of a hilltop or to describe the building of an observation tower to command important terrain.² Medieval commanders in addition to building watch towers on

¹ Philip Guedalla, Wellington (New York: Harper and Bros., 1931), pp. 220-221.

² Julius Caesar, Caesar's War Commentaries: De Bello Gallico and De Bello Civili, trans. and ed. John Warrington (London: J. M. Dent and Sons, Ltd., 1953), pp. 11, 13, 32, 39 et passim.

the hills improved upon the ancients by constructing movable towers from which they looked over the battlements of walled towns. On the day before the Battle of Salamanca an ingenious British captain of Marines sought an audience with Wellington to demonstrate a device that he called "an artificial hill," designed for observation. In the years that followed, the cavalry's traditional role in military operations was that of the eyes of the army. From Wellington's day to our own, there has been no change in the principle of warfare which requires a commander to possess that information of the enemy sufficient to determine his capabilities.

Despite the fact that it is as important to armies of today as it was to the legions of Caesar, we are not concerned here with terrestrial observation, but rather with the history and development of that type of observation which only within the last century has broadened the visual perspective of the military commander--aerial observation. We shall treat the instruments of aerial observation in the chronological order of their development: first, the balloon; and later, the military airplane.

Lighter-than-Air Craft

The mythology and folklore of nearly all nations have accounts of winged monsters and of mortals who defied the gods in attempts to fly. The Greek legend of Daedalus and Icarus, his son, belong to a period prior to 300 B.C.³ The flying carpet fantasy of the Arabian

³Ernst Schnabel, Story of Icarus (New York: Harcourt, Brace and Co., 1960).

Nights is probably the relic of a story of the desire for aerial flight. The first recorded efforts of man to soar above his mountains, towers, and "artificial hills" were accounts of experiments with balloons, and until the end of the last century most of the attempts to solve the riddle of flight were concentrated upon this medium.

According to various historians sometime during the fourteenth century when belligerents in western Europe were hacking at each other with battleaxes and broadswords and peering over castle walls from towers covered with oxhides, the Chinese were deftly disposing of their enemies with gunpowder, and sending up fire balloons fashioned from paper, a substance that was all but unknown in Europe. There are no records, however, to indicate that these balloons carried passengers.⁴

During the later middle ages, churchmen began to manifest an interest in aeronautics. One priest, noting that empty egg shells were very light and that the dew rose from the grass in the early morning sunlight, suggested that if egg shells filled with dew were heated by the sun's rays, all that was necessary to raise any weight was to collect enough egg shells and dew. Another cleric, John Wilkins, Lord Bishop of Chester during the middle of the seventeenth century, gave it as his fixed opinion that men might achieve flight in any of the following ways: with the spirits of angels; with the help of fowls; with wings fastened to the body; or with a flying chariot.⁵

⁴ Joseph Needham and Wang Ling, Science and Civilization in China (Cambridge: Cambridge University Press, 1954, 1959), I, 251; III, 167.

⁵ Leslie Stephens and Sidney Lee (eds.), The Dictionary of National Biography (London: Oxford University Press, 1937), XXI, 264.

In 1670, a Jesuit friar, Francesco de Lana-Terzi, after working on a vacuum balloon for some time abandoned his researches, for, as he piously wrote:

God would not suffer such an invention to take effect, by reason of the disturbance that it would cause to the civil government of men. For who sees not that no city can be secure against attack, since at any time our ship may be placed directly over it, and descending down may discharge soldiers; that the same it would happen to private houses and ships on the sea; for our ship, descending out of the air to sails of seaships . . . may upset them, kill their men, burn their ships by artificial fireworks and fire-balls. And thus they may not only to ships but to great buildings, castles, cities, and with such security that they which cast these things down from a height out of gunshot, cannot be offended by those from below.⁶

On June 5, 1783, the Montgolfier brothers, Joseph and Jacques Étienne, duplicated the feat that the Chinese had reputedly achieved nearly 500 years earlier, and kept a small balloon in the air for a few minutes. Four months later they sent up a sheep, a rooster, and a duck by a larger balloon. The Montgolfier balloons, which the French called globes aérostatiques and later simply montgolfières, were raised by hot air produced by burning straw, rags, and chopped wood. The inventors and their contemporaries thought that they had discovered a new gas, which ~~they~~ called for themselves. It was only a short time before the error of this claim was proven.

A French physicist, J. A. C. Charles, discovering that the rarefied air of the montgolfières was only one half as heavy as cold air, hit upon the use of hydrogen, which recent English experiments had found to be only one fourteenth as heavy. The first hydrogen balloon was sent up from Paris on August 27, 1785. It came down about 15 miles

⁶Maurice J. Davy, Interpretive History of Flight (London: H. M. Stationery Office, 1948), pp. 22-23.

from its ascension point and was destroyed by the terrified peasants who believed it to be a monster from the skies. After puncturing the envelope with muskets and pitchforks they tied the shrinking bag to a horse's tail and sent the beast galloping across the country until the balloon was torn to shreds. The French Government took steps to prevent such action in the future by publishing a lengthy explanation assuring the countrymen that the bags were harmless and "might someday prove serviceable to the wants of Society."

For Jean François Pilâtre de Rozier the Montgolfiers built a bag over six feet high to which they suspended a basket three feet square. To sustain flight they placed an iron grate under the bag in which a fire was to be kept burning during the flight. De Rozier's friends protested against his offering himself to science and suggested that two condemned criminals be sent up in his place (this had been done previously when a man was given the choice of being hanged or of jumping from the top of Notre Dame cathedral in a glider). De Rozier protested that such a suggestion was highly improper for no criminal should be permitted the honor of being the first human to fly. De Rozier's first flight, which took place on October 15, 1783, lasted only four and one half minutes. The balloon, anchored by a rope, rose to a height of 84 feet. During the next few weeks he made a number of captive flights with André Giraud de Vilette, who, it is of interest to note, was concerned with balloons primarily as an instrument of military reconnaissance. Two months after his first captive flight, De Rozier, accompanied by the Marquis d'Arlande, an officer of the Army, made the

first free flight in history over Paris.⁷

The next step in aerial transportation was the crossing of the English Channel. In June, 1785, De Rozier and a companion ascended from France in a combination heat-supported envelope and hydrogen sphere. They had been waiting for months for favorable winds but unhappily the winds during their voyage shifted and blew them back over the French coast. At a height of 6,000 feet the hydrogen balloon exploded, probably aggravated by the hot air balloon, and the aeronauts were dashed to the ground.⁸

Jean Pierre François Blanchard, financially backed by an American, designed and flew a balloon across the English Channel in 1785. Dr. John Jeffries, a physician from Boston, paid £700 to build the balloon and an additional £100 for the privilege of riding in it.⁹ In their flight from Dover to Calais the fliers had to jettison all their ballast, their navigational instruments, food, water, all their clothing, and finally, to quote Dr. Jeffries:

I felt the necessity of casting away something to alter our course; happily (it almost instantaneously occurred to me, that probably we might be able to supply it from within ourselves), from the recollection that we had drunk much at breakfast; and not having had any evacuation . . . that probably an extra quantity had been secreted by the kidneys, which we might now avail ourselves of by

⁷ Ramsay W. Phipps, The Armies of the First French Republic (London: Oxford University Press, 1929), II, 59.

⁸ Postscript to a letter from Thomas Jefferson, United States Minister to France to James Monroe, dated June 19, 1785, in Julian P. Boyd (ed.), The Papers of Thomas Jefferson (Princeton: Princeton University Press, 1953), VIII, 233.

⁹ B. Jay Jeffries, "First Aerial Voyage Across the English Channel: Diary of Dr. John Jeffries, the Aeronaut," Magazine of American History, XIII (January, 1885), 66-68.

discharging. . . . The event fully justified my expectation . . . and we were enabled to obtain, I verily believe, five or six pounds of urine; which circumstances, however trivial or ludicrous it may seem . . . was of real utility to us.¹⁰

This was the first aerial Channel crossing; others followed, and free ballooning became an accepted fact. The successful passage of this important bit of water has for centuries been the hallmark of success, as witness the Romans, the Normans, and in 1785, the balloon.

Less than a year after his successful crossing, Blanchard opened a "Balloon and Parachute Aerostatic Academy" near London and began to give instruction in ballooning. An attempt to let down a sheep in a parachute before a paying audience proved so unsuccessful that to avoid being mobbed Blanchard was forced to refund the admission fees. This disgusted him with England and he moved to Germany and later to America.

The military balloon made its first appearance on June 2, 1794, shortly before the Battle of Fleurus, when the French Revolutionary Army under General Jean Baptiste Jourdan opposed the Austrians. Captain Jean Marie-Joseph Coutelle, the pilot, had been experimenting with balloons for some time at Meudon, and his reconnaissance over Maubeuge appears to have been effective not only as a means of observation, but also as a morale factor in its disturbance of the Austrians. Other balloons were built for Coutelle during the Revolutionary Wars and these balloons were still in use when Napoleon came to power.

Napoleon was initially enthusiastic about the balloon for

¹⁰ John Jeffries, A Narrative of the Two Aerial Voyages of Doctor Jeffries with Mons. Blanchard (London: J. Robinson, 1786), p. 86.

military reconnaissance and gave Coutelle ample support in developing his service. In 1797 he directed the organization of a balloon company for service in his expedition to Egypt. At the naval battle of Aboukir Bay most of Coutelle's equipment was destroyed, and use of balloons in Egypt was directed more toward demonstrating France's technical prowess than toward the tactical employment of aerial observation. Coutelle salvaged some of his balloon units and brought them back to France where they were gradually demobilized in the waning years of the eighteenth century. The old balloons, however, were used occasionally in exhibition flights about Paris. Gaily decorated balloons used during the celebration marking Napoleon's coronation as emperor were subsequently turned over to Joseph Gay-Lussac, who employed them in his researches in physics and electricity.

Later, on several occasions, attempts were again made to interest Napoleon in balloons. In 1808 Major Nicholas Lhomond submitted a plan which called for the construction of a fleet of balloons, each capable of transporting a thousand troops, two cannon, and twenty-five horses across the English Channel. A few years later, during the retreat from Moscow, it was proposed to speed the Emperor on his way by the use of a balloon. Napoleon would have nothing to do with any of these schemes. The balloonists that he disbanded following his Egyptian campaign might have been quite valuable to him. The Battle of Waterloo was lost due to Napoleon's inability to find out where his reinforcements were, and what had become of the Prussians that Wellington was expecting. By a strange coincidence, Waterloo, a word that now denotes more than a place name, was fought on the same battlefield as the

Battle of Fleurus, just 21 years after Coutelle made his reconnaissance over the Austrians.¹¹ After Coutelle, nothing important occurred in military aeronautics in France for 50 years.

In the 1820's military ballooning in Europe entered an era of unspectacular research and development. The use of balloons as aerial platforms for reconnaissance and signaling was altered to provide also for the dropping of bombs and propaganda. Interest in the use of balloons with armies was revived in 1855-1856, during the Crimean War. The English discussed the feasibility of employing balloons for reconnaissance and bombardment, and at the siege of Sevastopol the Russian forces had a balloon which made several ascensions. Little is recorded of the role played by balloons in this conflict; their contribution to the outcome of the siege seems to have been slight. Napoleon III engaged the services of two leading French aeronauts in 1859, Louis and Eugène Godard, during the Italian campaign against Austria. Reconnaissance ascensions were made at Possuoli, at Castenedolo, from the Castiglione Hills, and at the Battle of Solferino, but they had little or no effect on the campaign.

During the 1860's, the British conducted some minor experiments with balloons for observation and reconnaissance at Aldeshot under Henry T. Coxwell, a civilian instructor. Interest in the projects died in the British War Office and Coxwell went to Germany in 1870 to train the German Balloon Corps.¹² The Germans used balloons in only

¹¹John F. C. Fuller, The Decisive Battles of the Western World and Their Influence upon History (London: Eyre and Spottiswoode, 1955), II, 492-542.

¹²Henry T. Coxwell, My Life and Balloon Experiences (London: W. H. Allen and Co., 1887), I, 52-79.

one operation against the French, but interest was stimulated in their development. Count Ferdinand von Zeppelin, who had been an observer with the Union Army during the American Civil War and had made his first ascent in a balloon at St. Paul, Minnesota, in 1863, served during the Franco-Prussian War as a cavalry officer, but was instrumental in maintaining interest in aerial flight in Germany. In the Franco-Prussian War Felix Nadar formed an organization named the Ballon Poste, for floating mail and passengers out of besieged Paris. "The entire Government escaped by balloon when the fall of the city seemed imminent."¹³

In 1884 Captains Charles Renard and A. C. Krebs of the French Army, working on designs of their own and financed by an Army appropriation of \$40,000, constructed a torpedo-shaped airship weighing 4,000 pounds and powered by a nine horsepower motor. Renard had patterned his balloon after a model that had been submitted to the French Academy almost 100 years before. But he added a motor that permitted his airship to fly by its own power and return to its starting point. In contrast to earlier balloons which could not carry observers to a definite destination, Renard's ship could maneuver in any direction.¹⁴

Subsequent developments led to the dirigible, of which one of the first was devised in 1897 with "an internal lattice framework and

¹³Samuel P. Johnston, Horizons Unlimited: A Graphic History of Aviation (New York: Duell, Sloan and Pearce, 1941), p. 272.

¹⁴"Airship," Encyclopædia Britannica, 1960, I, 463.

an aluminum skin."¹⁵ Finally, after many attempts and many disasters, in the beginning of the twentieth century simultaneously with the development of the airplane, Albert Santos-Dumont and Count Zeppelin, working on very different lines, developed the airship to a practical stage.

In 1904 the Juillot-Lebandy airship which the French had been developing since 1896 was perfected. In the next year experiments in aerial bombing were carried out and in 1906 the French Government ordered its first airship. In 1907 the French began a regular school of aeronautical instruction for pilots, mechanics, and ground crews at Chalais-Mendon, where Coutelle had begun his experiments in 1794.

By 1914 France, Russia, Germany, England, and the United States had semirigid airships that had been employed in military maneuvers and had communicated with the ground. Germany alone had adopted the rigid Zeppelin powered by gasoline engines and later by diesel motors as a military weapon. Lighter-than-air navigation was an established fact but the interest of the world of aviation now turned to the rapidly developing heavier-than-air machines.

Heavier-than-Air Craft

In the light of the present importance of lighter-than-air in proportion to heavier-than-air aviation, the treatment of the former may seem out of proportion. It should be borne in mind, however, that in

¹⁵Watson O. Pierce, Air War: Its Psychological, Technical, and Social Implications (New York: Modern Age Books, 1939), p. 272.

the development of observation aviation it was in the lighter-than-air field that progress was most consistent and most productive up to the beginning of the present century.

During the middle ages when men interpreted ancient writings instead of experimenting, they wrote boldly about flying. A few, less wedded to exegesis, studied the mechanism and flight of birds. Roger Bacon, in the thirteenth century, wrote of

instruments to flie withall so that one sitting in the midst of the instrument, . . . doe turne an engine, by which the wings, being artificially composed, may beat the ayre after the manner of a flying bird.¹⁶

In succeeding centuries there came an increasing group of aerial enthusiasts, with more optimism than method, who learned at painful cost that flying requires more than paddles and other air-beating devices attached to arms and legs.

Early in the sixteenth century, the incredible Leonardo da Vinci took leave of his painting long enough to invent a tank, design artillery, and build movable bridges. In addition to this, he designed an ornithopter (a flying machine powered by flapping wings) and a helicopter (a machine which rises by the action of a horizontal rotating fan), and a much less complicated device which he felt might be useful in connection with either machine--the parachute. He was successful in flying models of his helicopter, and left in his notebooks plans for a machine 96 feet in diameter, with a frame of bamboo and iron and a covering of starched linen. He devised also a propeller for use on his

¹⁶As quoted in James R. Newman, The Tools of War (Garden City, N.Y.: Doubleday, Doran and Co., 1942), pp. 268-269.

ground vehicles and studied the flight of birds and the resistance of air to their flights.¹⁷

About the same time that Leonardo began his aeronautical researches, one of his countrymen, Baptiste Dante, announced to the world that he had made a successful glider flight in northern Italy. No one was looking when Baptiste took to the air and his contemporaries scoffingly suggested that he and his glider might do well to join the other Dante, who two centuries before had recounted his travels in the Inferno.

Joseph Addison, the English essayist, objected to flying and in 1713, writing in response to a letter from "Daedalus," he declared that flying

would fill the world with innumerable immoralities and give such occasions for intrigues as people cannot meet with, who have nothing but legs to carry them. You should have a couple of lovers make a midnight assignation upon the top of the monument, and see the cupola of St. Paul's covered with both sexes like the outside of a pigeon house. Nothing would be more frequent than to see a beau flying in at a garret window, or a gallant giving chase to his mistress, like a hawk after a lark.¹⁸

The Marquis de Bacqueville decided to use the roof of Notre Dame in Paris, instead of the cupola of St. Paul's cathedral. One morning in 1742, after attaching paddle-shaped wings to his wrists and ankles, he attempted to fly across the Seine River. Unfortunately, he flew only as far as a washerwoman's barge a few feet from the bank and

¹⁷ Bern Dibner, Leonardo da Vinci: Military Engineer (Portland, Me.: Southworth-Anthoensen Press, 1946), pp. 22-27.

¹⁸ Henry G. Bohn (ed.), The Works of the Right Honourable Joseph Addison (London: George Bell and Sons, 1888), IV, 215.

broke both his legs. He immediately announced his retirement from further research and spent the rest of his life explaining why he had tried to fly, and why he did not intend to do any more of it.

Around 1810 Sir George Cayley built a glider that worked, one that would really carry a man in the air. The man-lifting glider, based upon a smaller model constructed a few years before, was a brilliant triumph, not alone because it flew, for there is evidence that a few earlier pioneers had managed to stay aloft for some seconds and land without breaking all their bones, but because it embodied sound aerodynamic principles, which Cayley had patiently discovered for himself. This glider was in many respects the prototype of the modern airframe. Cayley realized that to build a flying machine it would be necessary to master the complex dynamic problem of several forces working in opposition to each other, to juggle out the resultant force, and then to build a glider which could fully utilize that force in order to remain aloft. The air was a strange, intangible, and unpredictable medium, difficult to observe and to understand. Yet Cayley, born in an age when the scientific method had largely replaced ancient catechisms, so thoroughly mastered aerodynamic principles that competent engineers believe that only the absence of a suitable motor prevented him from achieving powered flight.¹⁹

Cayley's "noble white bird," sailing majestically from the top of a hill to any given point on the plain below with perfect steadiness

¹⁹ Pierce, Air War: Its Psychological, Technical, and Social Implications, pp. 269-270. For a fuller account of Cayley and his work see John L. Pritchard, Sir George Cayley (London: Max Parish, 1961).

and safety, fired the imagination and throughout the nineteenth century experimentation went forward vigorously in England, Germany, France, and elsewhere. Some of the leading names were J. Stringfellow, who in 1848 built the first successful airplane model powered by a tiny steam engine; W. S. Henson, who formed "The Aerial Transit Company" in 1843, with a prospectus for the benefit of stockholders, showing airports of the company in India; Alphonse Penaud, who built model planes that really flew, powered by rubber bands; Horatio Phillips, who built wind tunnels to study wing contours and powered his experimental ships with steam engines; and the inventive Sir Hiram Maxim, of machine gun fame, who built monstrosities that, in 1894, lifted themselves off the ground a bit while whirling dizzily around a circular track to which they were fixed.²⁰

One of the truly great pioneers, brilliant but dogged by incredible and persistent bad fortune, was Samuel P. Langley. This American ex-architect, in association with Charles M. Manly, built steam-powered contraptions called aerodromes. Somehow they never did fly, but experts who examined them in light of present knowledge adjudged them capable of flight and Langley's planes at worst must be considered magnificent failures.²¹ The Langley-Manly airdromes,

²⁰"Aeronautics," Encyclopaedia Britannica, 1960, I, 242-243.

²¹Langley got \$50,000 from Congress at the time of the Spanish-American War to conduct experiments for the War Department. He was fortunate in getting the cooperation of Charles Manly. Manly's engines, weighing 125 pounds, developed 52 horsepower and were far in advance of anything known at his time. One of his best machines, weighing only 2.4 pounds to the horsepower, was built in spite of the assurances of all the eminent engineers consulted that no machine could do as well as 8 pounds per horsepower. The engine was five cylindered and liquid

piloted by Manly, were launched in 1903 from Langley's houseboat in the Potomac River. In the words of one of the onlookers, his full-sized ship "slid into the water like a handful of mortar." All seemed well in the test until the moment of take off.

An instant later there was a crash, the after part of the ship fell upon the deck of the houseboat, while the forward part in which Prof. Manly was seated, rose slightly, then turned completely over and dropped into the water a few feet away, without having flown a foot.²²

During the same year as Langley's fiasco, Wilbur and Orville Wright, who owned a bicycle shop in Dayton, Ohio, installed an engine in a glider with which they had been experimenting. Their contemptible patch box of wood and linen, held together by glue and wire and powered by a wheezing, four-cylinder engine, was little more than a witch's broomstick, but it could fly. On the morning of December 17, 1903, at the desolate beach of Kitty Hawk, North Carolina, in a halting, erratic flight of 120 feet, modern flying, as we know it, was born. Only five people watched this 12-second performance against a 21-mile wind. Four successful flights were made that day, the longest lasting 59 seconds and covering a distance of 852 feet.

The Wrights' great advance was not only in constructing a suitable engine, for Manly had done that before them, but in their idea of achieving balance and steering in flight by means of a few wires which twisted and warped the wings of their biplane in any manner they

cooled; it was run in a test for ten hours without stopping at a time when the average automobile had all it could do to keep from bubbling over after 15 or 20 miles on the road. Indeed, Manly's motor was one which was to be unequalled by airplane engines for many years to come.

²²New York Times, December 9, 1903, p. 1.

wished. Their flight was no accident, for they had prepared with the utmost care. In constructing their propellers they learned to avoid Langley's mistakes and even built themselves a wind tunnel. In building their preliminary gliders they learned from the contributions to aerodynamics made by Otto Lilienthal and Octave Chanute, pioneers in glider experiments.²³

Meanwhile, flying machines were being constructed in France, England, and elsewhere in Europe. Louis Bleriot, Alberto Santos-Dumont, Henri Farman, and H. Latham were among those who contributed to the rapid development of aviation which preceded World War I. They flew astounding distances, and to amazing heights in their rickety and capricious crates. They stunted, but they also studied the peculiar properties of the strange medium to which they were entrusting their lives. Alberto Santos-Dumont, the wealthy sportsman who in 1901 had sailed one of his cigar-shaped airships around the Eiffel Tower, experimented with planes and built the first airplane to fly in Europe. He also built a tiny monoplane, weighing only 250 pounds, called the Demoiselle, which could easily be taken apart and carried around the country in his automobile. On July 25, 1909, Louis Bleriot crossed the Channel, landing in a meadow behind Dover Castle, not far from the spot from which Blanchard and Jeffries had ascended in their balloon for the first lighter-than-air crossing 120 years before.²⁴

²³ Lilienthal, a German, who made over 2,000 glider flights, is credited with the discovery of the advantages of curving flat wing surfaces. Chanute, in the United States, designed, constructed, and flew aircraft with movable surfaces.

²⁴ Johnston, Horizons Unlimited: A Graphic History of Aviation, p. 276.

By 1914 airplanes had gone as fast as 127 miles an hour, flown as high as 25,000 feet, and sustained flight limited only by the capacity of the plane's fuel tanks. No longer was the plane a skeleton fuselage uncovered by fabric. Instead of being precariously perched on a rickety seat, nightmarishly exposed, the pilot was partially enclosed in a cockpit with a windshield to protect his head. The forward-mounted controllable elevator was found to be too sensitive, and the rear tailplane, with hinged flaps to serve the function of elevators, became common. The predominant type was the biplane, because it was found more stable and structurally safer. Monoplanes at that time had a disconcerting habit of falling apart in mid-air when the pilot tried anything besides level flight. Thus, at the onset of World War I, aircraft had reached a stage of development where they could be employed effectively for military use.

CHAPTER II

UTILIZATION OF AERIAL OBSERVATION IN THE EARLY TWENTIETH CENTURY

The foregoing survey of the history of aeronautics, touching upon its proposed use in war, was synonymous with the history of observation aviation, for initially all military flying, both in balloons and in airplanes, functioned primarily as the eyes of the commander and not as an offensive weapon. In fact, in 1898 the Hague Peace Conference sought to prohibit all types of aerial missions but innocent reconnaissance.¹

The Russo-Japanese War, 1904-1905

The first combat use of aerial observation in the twentieth century came during the Russo-Japanese War of 1904-1905. Writing at the siege of Port Arthur in 1904, Sir Ian Hamilton, a British observer with the Japanese armies, declared:

The Russians are sending up balloons to our front, and in front of the 12th Division. Judging by maneuvers and our South African experiences, they should now obtain a lot of misleading information.²

¹ See note number 25 on page 35 for a fuller account of the efforts of the Hague Peace Conferences to limit the use of airplanes.

² Ian Hamilton, A Staff Officer's Scrap Book During the Russo-Japanese War (London: E. Arnold, 1905), I, 273. At Gallipoli in 1915 Hamilton was forced to postpone his initial landings because of his lack of even misleading intelligence.

In August, 1904, during the Japanese advance on Russian-held Liaoyang, a Russian captive balloon which was not mobile was the only one to appear in combat.³ Early in December, 1904, a provisional balloon battalion arrived at the front and a gas plant was established near the railroad at Mukden. This unit was equipped with two 5,000 cubic foot spherical balloons, each capable of carrying two men. During the Battle of Chentanpu a balloon was taken to a point about 15 miles southwest of Mukden but was not used, as the battle occurred during a blinding snowstorm.⁴

During the Battle of Mukden in March, 1905, the Russians had one balloon in the air for three days. It always ascended at least two and a half miles to the rear of the advanced infantry line. The observer reported his findings by means of a telephone whose wire was in the anchoring cable. An American officer travelling with the Russian staff reported that the Russians found the balloon of little value.⁵

At Vladivostok on nearly every clear day an inflated balloon

³Report No. 3 of Capt. Peyton C. March, United States General Staff Observer with the Japanese Army, dated October 5, 1904. U.S. War Department, Reports of Military Observers Attached to the Armies in Manchuria During the Russo-Japanese War (Washington: Government Printing Office, 1906), I, 29.

⁴It is of interest to note that during the Battle of Chentanpu a Russian general, commanding a battery of about 200 seige guns near the railroad, proposed to direct his fire from a balloon. The inclement weather, however, made this impracticable.

⁵Report of Capt. William V. Judson, observer with the Russian forces in Manchuria. War Department, Reports of Military Observers Attached to the Armies in Manchuria During the Russo-Japanese War, 1907, V, 184.

was taken onto a large tug which was provided with a large square-sail wind screen. The tug then proceeded out of the harbor to the mine field, where two officers ascended to a height of 400 to 800 feet. As the tug cruised about slowly, submarine mines could be clearly seen and their positions verified. Hostile mines were sought out and the horizon was searched for Japanese vessels. This use of balloons by the Russians impressed one American army observer who wrote that

Doubtless a balloon ship would be of great value for naval use under many circumstances, to enable observations to be made of the interior of a hostile harbor, with a view to ascertaining the vessels there, and for the purpose of studying the mine field.⁶

The Italo-Turkish War, 1911-1912

The Italo-Turkish War of 1911-1912⁷ furnished the airplane with its first opportunity of participating in military operations under war conditions. The Turks, however, had no planes to employ in any of the campaigns. The flying machines used by the Italians were mostly single-seated craft powered by 50 horsepower Anzani motors. These planes, of which there was a variety of types, were capable of attaining an altitude of only 3,000 feet and were limited to flights of less than two hours duration. In spite of the difficulties of servicing these crude craft, reconnaissance missions were flown during the desert campaign and the information secured was of use to the Italian forces.

⁶ Ibid., p. 185.

⁷ The popular name for this war is somewhat misleading; it might better be known as the War for Libya. The name "Russo-Japanese War" is also a misnomer. Most of the fighting of this conflict took place at sea. Manchuria played host to the armies of Japan and Russia who brought considerable devastation to the land they sought to occupy.

At the onset of operations, the Italian commander was not inclined to put much confidence in aerial photographs and relied upon inaccurate and obsolete maps. Reports from aerial observers were, for the most part, discounted. The enemy assault of October 28, 1911, on the Italian positions broke down completely because of redeployments based on the reports of Italian fliers in the days immediately preceding the attack.

In December of the same year, at the battle of Ain Zara, Italian forces gained a decisive victory which snapped the backbone of hostile resistance. Before the battle, concentrations of enemy troops were located and sketches of the terrain indicating the routes of enemy advance were made by the Italian fliers. Even the retreat of the enemy was reported to the Italian commander.⁸

Unlike many earlier belligerents the Italians kept the results of their combat reconnaissances a secret. Following the war no reports of the use of aviation were published, and military attachés found little to report to their home countries concerning the war use of aircraft. They were able, however, to draw their own conclusions when, in 1912, Italy began feverishly to build and to buy airplanes.

The Balkan Wars, 1912-1913

Whatever developments the Italo-Turkish War had produced in the

⁸The best accounts of the Libyan War are Arrigo Solmi, The Making of Modern Italy (New York: Macmillan Co., 1925), pp. 167-173; Benedetto Croce, A History of Italy, 1871-1915, trans. Cecilia M. Ady, (Oxford: Clarendon Press, 1929), pp. 259-265.

area of military employment of aircraft disappeared during the Balkan Wars of 1912-1913. Both the Turks and the Balkan Allies seem to have realized the value of aerial observation.⁹ Having no aviation organization of their own, they purchased foreign aircraft, chiefly French and Italian, and hired foreign pilots, French, Russian, and Swiss, to fly them. The results obtained were practically negligible. A lack of trained observers or of reliable maps, the absence of any ground organization to support the aerial operations, all contributed to the meager results. Many military leaders throughout the world continued to regard the airplane as little more than a plaything and of little value even as a means of securing information. A German officer, who had served as part of the training mission to Turkey, criticized the Turks for using aircraft instead of horses for reconnaissance transportation. He concluded:

Recent experience confirms in an irrefutable manner, the opinion always held by authorities on higher strategy that if victory is to be rendered not merely decisive but complete, then a large force of cavalry with its convenient mobility is indispensable.¹⁰

The European War, 1914-1917

The doctrine of the offensive à outrance, which dominated the thinking of most of the military leaders of Europe in the years immediately preceding the outbreak of World War I, reduced all strategical

⁹Ernst C. Helmreich, The Diplomacy of the Balkan Wars, 1912-1913 (Cambridge: Harvard University Press, 1938), pp. 193-230; 380-382.

¹⁰Lancelot Lawton, "A German View of the Turkish Defeat," Fortnightly Review, XCIII (May, 1913), 986.

concepts to a bold offensive. The lectures of Lieutenant Colonel De Grandmaison, Chief of the Operations Bureau of the French General Staff, delivered at the Center of Higher War Studies during the summer of 1911, were translated into many languages and were enthusiastically studied by students of the art of war.¹¹ The headlong offensive was a simple formula: a determined advance at all costs to impose the commander's will on the enemy, making the latter's movements of little importance. It was De Grandmaison who said, "For the attack only two things are necessary: to know where the enemy is and to decide what to do. What the enemy intends to do is of no importance."¹² This doctrine lessened the commander's dependence upon reconnaissance.

Although the basic system was the same, it was variously applied by different nations. In Germany the bold advance was based on a hypothesis as to the enemy's positions followed by an enveloping attack. The conclusions about the enemy were to be based on a determination of the best means open to the foe rather than on actual information from air or ground scouts. Then the armies, corps, or divisions were to march around the enemy's flanks.

The basis of this system was the German experience that intelligence about the enemy would not be forthcoming in time to allow a commander to formulate plans based on it. The various commands were accustomed to tardy, incomplete, and often inaccurate reports and their

¹¹Basil H. Liddell Hart, Strategy: The Indirect Approach (New York: Frederick A. Praeger, 1954), p. 167.

¹²As quoted in Cyril Falls, The Great War (New York: G. P. Putnam's Sons, 1959), p. 35.

ready acceptance of a solution which allowed them to disregard reconnaissance was not difficult to understand.

Improved airplanes and dirigibles appeared too shortly before the outbreak of World War I to disclose any potentiality which might have induced German leaders to change the system. The air service became merely a means of checking the accuracy of the command's hypothesis. There was no feeling that such a check was absolutely necessary and consequently no particular regard was shown to the air service.

As a result of the German interpretation of the offensive à outrance, the tactics and technique of German military observation were not highly developed. In fact, there were certain crudities which were almost unbelievable in view of the pride of Germany's prewar army in its efficiency. The air observer was considered merely as the flying counterpart of a cavalry scout. Both made visual searches and rendered oral and written reports to the commands together with sketches or maps. There was, however, a great deal of difference between the horizontal view of the cavalryman and the possibility of vertical observations of the airman. The limited search of the former as compared with the large-scale examination of the latter was overlooked. The difficulties and limitations of aerial observation were not appreciated. Most commanders considered the airplane to be simply an elevated platform from which any officer accustomed to terrestrial reconnaissance could make a satisfactory search. The need for extensive specialized training was not recognized.

Experience might have helped the airmen but only a few were

fortunate enough to have participated in the annual Emperor's Maneuvers which afforded the only opportunity for practice in large-scale troop movements. Most fliers had trained with only the small garrisons stationed at army posts. At minor maneuvers the smallness of the area made it comparatively simple to find the "enemy." If the observer was uncertain of what he saw, he could generally make a good guess because he knew with whom he was training. Little or no attention was paid to flying airplanes at levels at which they would be forced to fly under battle conditions.

Inexperience with aerial reconnaissance was not merely a fault of the airmen. Comparatively few commanders had the opportunity of working with air observation before the war began. Methods which would have assisted ground commanders in discharging missions were unknown. No conception existed of the necessity for defining and limiting missions, for outlining the scheme of maneuver in order to obtain an intelligent performance of the air missions, or for specifying the desired information.

Little mention has been made of the German army dirigibles. The great amount of publicity which surrounded them, particularly the Zeppelins, was principally window dressing. On paper they had various functions; actually their alleged advantages were scarcely remembered when the war began.

Some acknowledgment of the sad state of German air reconnaissance came shortly before the war when 50 officers were sent from the War Academy at Döberitz for a short course in the tactics and technique of air reconnaissance. This study was not only for their benefit but to

bolster the reputation of the air service by attaching officers with tactical background to it. The effect, however, was nullified by the failure of the airmen in the reconnaissance before the war. This development shook the faith even of air enthusiasts. Faced by a partly justified distrust in air intelligence, the small German air force prepared to serve in a war which many observers believed would cause its quick collapse.

Among Germany's opponents, France and Russia had the largest armies.¹³ Both were eager exponents of the concept of the offensive à outrance. In France this system represented a recent change. Up to about 1912 most authorities had contemplated an initial defensive based on frontier fortresses, followed by a vigorous offensive.¹⁴ The first period gave the French commander an opportunity to ascertain the enemy's intentions and to base his offensive on the results of this information. This system encouraged all means of reconnaissance. Military aeronautics flourished in this fertile field and by 1912 France was acknowledged the foremost exponent of aerial observation.

It should be noted that during this period of expansion of military aviation, many responsible officers were quite slow to sense the values of aerial observation. In 1910 a group of French officers from the École de Guerre spent an afternoon at some air races near Paris. An elderly general among them, École de Guerre Commandant Ferdinand Foch, when asked by a newspaper reporter what he thought of the show replied,

¹³Russia had 114 infantry divisions. The French mustered 62 divisions, Great Britain 6, Germany 87, and Austria-Hungary 49.

¹⁴Liddell Hart, Strategy: The Indirect Approach, p. 167.

referring to a race then in progress: "That is good sport, but for the army the aeroplane is worthless."¹⁵

General Joseph Jacques C. Joffre, who was appointed Chief of the General Staff in 1912, served as the tool for the proponents of the offensive à outrance. The new doctrine was blunt in its disregard of reconnaissance. Like the German authorities, the French General Staff was of the opinion that intelligence would always be incomplete, inaccurate, and tardy. They were candid in pointing out the weakness of contemporary aircraft and under their attack French military aeronautics sank to the levels of its German counterpart.¹⁶

The publicity given to the German military dirigibles induced some French authorities shortly before the war to believe that there was some value in this type of aircraft. A construction program was launched and a dirigible boom began. The war interrupted this before it had an opportunity of making more than a superficial impression on the attitude of the military authorities.

The offensive à outrance theory appealed to the Russian commanders just as it did elsewhere, with the usual adverse effect on

¹⁵ Basil H. Liddell Hart, Foch: The Man of Orléans (Boston: Little, Brown and Co., 1932), p. 44.

¹⁶ The myth of France's superiority in military aviation over Germany at the beginning of World War I is continued by many authors. Statistics showing the number of pilots, airplanes and observers in the French air service rarely go beyond the year 1912, the year marking a downward turn in the development of this arm of the French military establishment. For an example of this mistake see Hans Speier's article on "Ludendorff: The German Concept of Total War," in Edward M. Earle (ed.), Makers of Modern Strategy: Military Thought from Machiavelli to Hitler (Princeton: Princeton University Press, 1943), p. 312. For a comparison of the air strength of the belligerents at the beginning of the war see pp. 33-34 infra.

Russian military aeronautics. If allowances are made for Russia's general backwardness in military technology, the development of its air arm was similar to that of France. By the beginning of 1913 there was evidence of an effort to set up an effective organization. With the introduction of the offensive à outrance doctrine, however, a decline set in. When the war broke out Russian commanders neither sought nor received any assistance from the air.¹⁷

The British army's conception of the proper employment of the air arm was one of reconnaissance. It was thought that planes might well be sent out to reconnoiter the enemy positions prior to the battle. Just as its army was small in comparison to the European masses, the British air force was likewise smaller. Its stage of development was about the same as elsewhere. It had not suffered the sudden fall from popularity of the French air service, however, and its morale was very high.

In a majority of the airplanes employed during the earliest phases of World War I, the observer sat in the front cockpit. On either side his view of the ground was partially cut off by either the monoplane's wing or the biplane's lower wing. Ahead of him was a projecting engine and exhaust pipe and sometimes a radiator. A maze of wires and braces and the engine exhaust were added impediments when he attempted to peer over the various obstacles. The cockpits were narrow and the movements of the observer were severely restrained.

¹⁷ Nicholas N. Golovine, The Russian Campaign of 1914: The Beginning of the War and Operations in East Prussia, trans. A. B. S. Muntz (Fort Leavenworth, Kansas: Command and General Staff School Press, 1933), p. 61.

Many of the airplanes in use were outdated by August, 1914, and even the more recent types were slow and carried fuel enough for a flight of only a few hours.

The military airplanes employed by the Germans in 1914 were divided into two groups. The "A" class consisted of monoplanes made by the Rumpler, Gotha, and Fokker aircraft manufacturers. The "B" class included biplanes chiefly of Albatros, Aviatik, and Otto manufacture. With the exception of the Otto pusher, both monoplanes and biplanes were tractor models (with the propeller mounted on the nose of the fuselage). Powered by 100 horsepower Mercedes engines, the machines had a flight endurance of four hours, a cruising speed of 55 to 60 miles per hour, and a load-lifting capacity of two persons and their specialized equipment.

Shortly before the war the German army proposed to build standardized two- and three-place machines but the commencement of hostilities caused the program to be dropped. At that time the indiscriminate purchasing of all available airplanes gave the army a collection of almost every type ever built in Germany.¹⁸

The first of the English military planes, built in 1912, was the Cody Cathedral; it had exposed seating accommodations and could reach the speed of only 30 miles per hour. By the beginning of the war the British were turning out the Sopwith Tabloid, which could fly 105 miles per hour. French military planes were perhaps a trifle better, but they were mostly converted from those used by civilian pilots in

¹⁸ Helmut Forster, "Die Entwicklung der Fliegerei im Weltkriege," in Walter von Eberhardt (ed.), Unsere Luftstreitkräfte, 1914-1918: Ein Denkmal deutschen Heldentums (Berlin: C. A. Weller, 1930), pp. 40-41.

crossing the Channel, fighting for prizes and new records.

There were neither bomb racks nor bomb sights, first because it was thought that that type of warfare was not feasible and that most were satisfied with the thought that their planes might be useful for limited scouting and observation; second, because if they had had the idea, their machines were doing well enough to get up into the air without carrying a load of bombs also. Defensive armor did not exist; a well-directed pistol shot which landed in the fuel tank would have been sufficient to send the best plane down in flames. That, then, was the picture of military aviation when the war opened in August, 1914. There were less than 200 airplanes in all of Europe fit to cross the Channel.

In regard to the number of aircraft available in 1914, France, with several hundred planes, had more than any other nation. Germany had, however, a more standardized air force.¹⁹ The Belgians had the best types, but their entire force totalled but 30 airplanes. The Russians had 80 airplanes, but only 40 pilots, and the types of planes were so different that unless a pilot had flown a great deal he had considerable trouble with a new type of airplane. Italy had a total of about 200 airplanes, half of which were French and British built, and half of which were slow, heavy ships of the pre-Caproni type.

¹⁹At the outbreak of the war Germany had about 254 military pilots and 271 observers. After the units at the front were supplied, however, there was little left over for reserves or training cadre. Georg P. Neumann (ed.), Die Deutschen Luftstreitkräfte im Weltkrieg (Berlin: E. S. Mittler und Sohn, 1920), p. 62. The Allied powers had even fewer military flying personnel.

At the onset of hostilities Germany had a nominal strength²⁰ of 180 airplanes on the western front.²¹ This force was faced by a force of approximately the same strength. With the units figured at nominal strength, the British had 48 airplanes,²² the French 136,²³ and the Belgians 24²⁴ making a total of 208. The Belgian air force accomplished little of value so that if it is omitted the Allies had 184 airplanes to the Germans' 180.

On the eastern front the Germans had a numerical superiority because the Russians apparently concentrated their small air service opposite the Austro-Hungarian armies. In the light of prewar German military aviation development it is not surprising that this initial superiority in numbers did not play any decisive role in the initial conflicts.

²⁰ Probably it is impossible to give the air strength accurately in numbers of machines. Obviously specific figures are exact for only a certain period of time. Nominal strengths are approximations based on the number of planes authorized for the aviation units at the front. Authors often fail to state whether their numbers are actual strength at a given date, whether they are describing front-line strength or grand totals including training and experimental machines.

²¹ Der Weltkrieg, 1914-bis 1918: Die militärischen Operationen zu Lande (Berlin: Reichverlag, 1925), I, 664-686.

²² Walter Raleigh, The War in the Air: Being the Story of the Part Played in the Great War by the Royal Air Force (Oxford: Clarendon Press, 1922), I, 411. This figure given by Raleigh includes some training planes which were still at the aviation parks in England. This work, and the later volumes by Henry A. Jones, is hereafter cited as The War in the Air.

²³ France, Ministère de la Guerre, État-major de l'armée, Les armées françaises dans la grande guerre (Paris: Imprimerie nationale, 1922), I, 31.

²⁴ Willy Coppens, Days on the Wing, trans. A. J. Insall (London: J. Hamilton, Ltd., 1934), p. v.

All of the belligerents had some type of air organization when war came to Europe in August, 1914. Their units, however, were limited to noncombatant function by the Hague conventions and declarations of 1907.²⁵

The British Royal Flying Corps, as it existed during the summer of 1914, was divided into a Military and a Naval Wing. The division between their functions was, however, a wide one, with the result that the Naval Wing quickly became known as the Royal Naval Air Service and then the title Royal Flying Corps came to stand for the Military Wing alone. The growth in each case was less rapid in numbers than in design and armament. By August, 1915, the British Expeditionary Forces had increased from 4 to 30 divisions but the Royal Flying Corps from

²⁵The pronouncements of international law on aerial warfare were vague. In 1899 at the First Hague Peace Conference a declaration was signed stating that the high contracting parties agreed to prohibit launching of projectiles and explosives from balloons or other aerial vessels for a period of five years. This prohibition was extended in 1907 at the Second Hague Conference until the Third Peace Conference (which was never held) but this declaration was signed by only 27 of the 44 powers represented. Of the nations involved in World War I, Belgium, Great Britain, and the United States were signers of this declaration. None of the other belligerents were obligated to these restrictions. It was obviously no restraint as it contained a provision that it was not binding when, in case of war between the contracting powers, one of the belligerents was joined by a non-contracting power. James B. Scott (ed.), The Hague Conventions and Declarations of 1899 and 1907 (2d ed. rev.; New York: Oxford University Press, 1915), pp. 220-222.

Article 25 of the Hague Convention of 1907 concerning the Laws and Customs of War on Land forbade the bombardment "by whatever means" of undefended towns, villages, houses, or dwellings. The quoted phrase was expressly inserted to cover aerial attacks. There was no definition, however, of "undefended." All of the major belligerents of World War I ratified this convention. Ibid., pp. 100-129.

The indefiniteness of international law allowed all nations concerned to insist that they alone observed the rules and that the others violated them. Actually, both sides were anxious to secure all possible advantages and only military and technical factors limited their aerial attacks.

4 to only 11 squadrons.²⁶

Under its peacetime organization German military aviation consisted of 5 battalions: 4 under the Prussian War Ministry and 1 under the Bavarian War Ministry. From these, 33 field aviation sections and 8 fortress aviation sections were formed when mobilization was ordered. Each army command and each army corps (except reserve corps) had a field aviation section. The Oberste Herresleitung (O.H.L.) had no aviation units under its direct control.²⁷

The French set up aeronautics as a separate branch of the army as early as 1912 and this policy remained in use until after the war began. The pilot and observer, however, were under separate commands. Aerial observation was within the domain of the army staff. In each army there was a staff officer designated "Chief of Air Reconnaissance Service." He and his observers (all staff officers) were attached to the Intelligence Section at army headquarters.²⁸ The observers even lived with the staff at army headquarters, going to the airdromes only to carry out their assignments. The air sections of an army were under

²⁶ Raleigh, The War in the Air, I, 331; 434-435.

²⁷ John R. Cuneo, Winged Mars (Harrisburg, Pa.: Military Service Publishing Co., 1942), I, Appendix XI. The O.H.L. was the German field command. The Kaiser's General Headquarters, the Grosses Hauptquartier, exercised a vague control over land, air, and sea forces. The French counterpart of O.H.L. was the Grand Quartier Général (G.Q.G.); the British, General Headquarters (G.H.Q.).

²⁸ Having staff officers as observers meant that the French observers had a better conception of the situation than their German counterparts. On the other hand the lack of ties with the pilots and their air corps had its obvious drawbacks. See Paul F. M. Armengaud, Le renseignement aérien, sauvegarde des armées (Paris: Librairie aéronautique, 1934), pp. 62 ff.

an aviation officer called the "Director of Aviation Service." It was his role to furnish the airplanes. He had no control over the observers.²⁹

It was not unusual for airmen to land in search of information during the early days of the war. It was a vestige of the custom of the cavalry to question inhabitants of a locality being scouted. One British observation crew on August 20, 1914, while on a search mission in the Brussels-Charleroi area, landed their machine in order to query the countrymen about the presence of Germans.³⁰ During that same month a German plane landed between two hostile forts during the attack on Liège and reported the combat situation at this point to its commander.³¹ The sources do not indicate what of value was seen and how it influenced the battle. Such use of airplanes as a sort of taxi service for observers, although perhaps interesting, hardly represented the most effective utilization of flying machines.

During the German advance through Belgium and northern France under the strategy of General Helmuth von Moltke's version of the Schlieffen Plan, the Germans, by not taking advantage of information furnished them by their aerial observers, lost an opportunity to destroy both the French Fifth Army and the entire British Expeditionary Force. On August 23, General Charles L. M. Lanrezac, commanding the

²⁹ Charles Delanney, "Le sort de nos observateurs en avion pendant la Guerre de 1914-1918," Revue des forces aériennes, I (November, 1929), 415-418.

³⁰ Raleigh, The War in the Air, I, 302.

³¹ Neumann, Die Deutschen Luftstreitkräfte im Weltkrieg, p. 397.

French Fifth Army, was holding a position southwest of Namur at the junction of the Sambre and Meuse Rivers. The German Second Army, under General Karl von Bülow, had crossed the Sambre at Charleroi during the preceding day and during the following morning had forced General Lanrezac's left flank back about four miles. The Meuse was crossed by the German Third Army, under General Freiherr von Hausen, near Dinant during the afternoon of the 23d. Lanrezac began to withdraw his rear elements during the morning of August 23 and at nine o'clock that night he ordered a general withdrawal.

Meanwhile, the British Expeditionary Force was holding a line from Givry to Mons and to the west along the Condé Canal facing the German First Army under General Alexander von Kluck. About 11:30 P.M. August 23 General Sir Joseph French, the commander of the British troops, received word that Lanrezac was withdrawing.³²

At 10:00 A.M. on the 23d the aviation units of the German Third Army reported that Lanrezac was beginning to withdraw to the southwest. A German division in the vicinity of Givet was ordered to proceed to the southwest, crossing the Meuse near Fumay to intercept the French movement. It planned to push forward towards Phillipeville in pursuit of the main force as soon as the Meuse had been crossed. The execution of this plan was held up, however, when a staff officer of the Second Army appeared and reported that the latter force was attacking the French at daybreak, for General von Bülow believed that

³² Joseph French, 1914 (London: Constable and Co., 1919), pp. 64-65. For a map showing the situation on the morning of August 23, 1914, see Figure 4 on page 418.

Lanrezac was holding his position in force just south of the Meuse, with his east flank ~~north~~ of Mettet. General Ernst von Hoeppner, who was then Chief of Staff of Von Hausen's Third Army, later wrote:

So it happened that a quick decision had to be made as to whether we should trust to the air intelligence given on August 23 or believe in the urgent requests from the Second Army. The latter prevailed . . . the Commander-in-Chief gave orders for the advance of the greater portion of our army toward the west.³³

Meanwhile, Lanrezac was moving rapidly to the southwest, and on the morning of August 24 occupied a line from Mazée to Chimay and northwest toward Maubeuge, with his left about 16 miles in rear of Sir John French's right. The British began their withdrawal early that same morning and closely pressed all the way by Von Kluck, reached the line La Longueville-Bavai-La Boiserette by nine o'clock that evening.³⁴

The combined effort of the German Second and Third Armies proved to be a blow struck at shadows. Before the day was over, the leading elements of both armies, confused in the converging routes of advance, were so mixed up that Lanrezac was able to continue his withdrawal that night almost without interruption.

Evidence that, during these critical days of 1914, the German commanders did not have much confidence in their aerial observation is found in the German official history, which, when commenting on this particular episode, concluded:

³³ Ernst W. A. von Hoeppner, Deutschlands Krieg in der Luft: Ein Rückblick auf die Entwicklung und die Leistungen unsere Heeres-Luftstreitkräfte im Weltkrieg (Leipzig: K. F. Koehler, 1921), p. 9-10. Hereafter cited as Deutschlands Krieg in der Luft.

³⁴ See Figure 5 on page 418 for a map showing the situation on the afternoon of August 23, 1914.

. . . the retreat of the English and French out of Belgium to the south and southwest was recognized by our aviators in every case, and especially on the fronts of the Second and Third Armies, as a planned and orderly movement, and not as we willingly believed, a disordered flight.³⁵

During World War I, before the entrance of the United States into the conflict, air power was used primarily to support ground operations. The air arms were subordinate elements of the army in each country and therefore were responsive to the demands of those services. Since the greatest concentration of effort was on land warfare, army commanders came to regard the flying machines as the "eyes" of the ground forces with the primary missions of observing the disposition of enemy forces and of spotting the emplacement of his artillery. It became apparent, even before the end of 1914, that measures would have to be taken to prevent enemy planes from carrying out their observation missions. For this purpose, planes with great speed, fire power, and maneuverability were necessary, and both sides set to work to develop them. This was the genesis of the fighter plane, whose mission was to destroy other planes and gain control of the air over the battlefield.

Although the contending air forces had been trained and equipped primarily for observation, airplanes were soon designed for other military roles. As the primitive aircraft on hand at the beginning of the war demonstrated, more specialized types of aircraft would have to be developed to perform as fighters and bombers. Airplanes grew steadily larger and heavier. The performance characteristics--speed, altitude, fire power, range--improved greatly. The changing fortunes

³⁵Hans Arndt, Der Luftkrieg (Leipzig: Johann A. Barth, 1923), p. 555.

of the air war between 1914 and 1917 were largely the result of aeronautical developments, with first one side and then the other gaining a temporary advantage because of some new and advanced type of plane or item of equipment.

No nation entered the war prepared for aerial combat. At the time, the Germans believed that the French had airplanes equipped with machine guns soon after the hostilities began.³⁶ The fact, according to one reliable French source, is that at the beginning of the war the entire French air force possessed only two machine guns.³⁷ One French airman later wrote the exact opposite to the German claims: "We were not armed! A simple carbine, a cavalry musket firing one shot at a time. They (and we knew it) often had machine guns."³⁸ Actually, neither the Germans³⁹ nor the French, nor the British Royal Flying Corps had machine guns on their planes when the war began.⁴⁰ One enterprising airman of the Royal Flying Corps mounted one on his machine during August, 1914, but was ordered to remove it because it added too much additional weight to his airplane.⁴¹

³⁶ Hoepfner, Deutschlands Krieg in der Luft, p. 23.

³⁷ Georges Huisman, Dans les coulisses de l'aviation, 1914-1918 (Paris: La Renaissance de l'livre, 1921), p. 20.

³⁸ Henri Chambre, "La premier victory de Navarre," Revue des forces aériennes, II (January, 1930), 6.

³⁹ Cuneo, Winged Mars, I, 131.

⁴⁰ Raleigh, The War in the Air, I, 260.

⁴¹ Charles F. Snowden Gamble, The Air Weapon, Being Some Account of the Growth of British Military Aeronautics From the Beginnings in the Year 1783 Until the End of the Year 1929 (London: Oxford University Press, 1931), p. 257. This work cited hereafter as The Air Weapon.

The French airmen seem to have been more aggressive than the fliers of the other air forces. This probably was due to a combination of factors. A great many of the French airplanes were pusher models. The pilot and observer sat in front of the wings with a clear forward field of fire unhampered by engine, propeller, or wires. Both the British and Germans had more tractor types in which the observer sat in the forward cockpit surrounded by wires and wings and with his potential field of fire forward restricted by the engine and propeller. The French aviators, moreover, were flying in defense of their own territory, which may have made them more inclined to seek combat rather than merely to cooperate with the ground forces by air scouting.

The total number of French air victories in 1914 appears to have been small but the Germans were convinced that all French airplanes carried machine guns. There were also widely publicized pictures of French Nieuports whose observers stood up through a hole in the wing to fire over the forward propeller. Actually, this and other models were simply experimental projects but even a German author admits that by February, 1915, "German airmen fled precipitately."⁴² This may only have been evidence of the low state of the German air service, which needed nothing more than the exaggerated threat of French aerial machine guns to show the effects of the strain caused by six months of combat.

Within a few weeks, planes of all sides seem to have begun to carry into combat a variety of weapons apparently limited only by the

⁴²Johannes Werner, Knight of Germany, Oswald Boelcke, German Ace, trans. Claud W. Sykes (London: J. Hamilton, Ltd., 1933), p. 93.

imagination of the airmen. There were singleshoot rifles and carbines, revolvers, automatic rifles and carbines, hand grenades (thrown or dragged on the end of a long cable to strike a hostile machine), steel arrows (originally designed for attacking ground forces), and small bombs. Even simulated weapons were carried aloft to awe the enemy.⁴³

The Germans secured the advantage in the summer of 1915 when they succeeded in mounting in a Fokker monoplane a fixed machine gun which could be fired forward through the whirling propeller.⁴⁴ This

⁴³One of the more amusing early dueling encounters in the air took place between a German and a British flying crew. "When the combatants had exhausted all their rifle and revolver ammunition, they blazed away with their Very [signaling] pistols, with which they made very poor shooting. After a while both pilots realized that the only chance of scoring a hit was to get close up, but when they laid their machines alongside, the humour of the situation struck . . . [the German pilot] so forcibly, so that he roared with laughter at the sight of the two observers solemnly loading up and taking deliberate aim, a green light answering a red one. Evidently the observers were also too tickled to shoot straight, for neither got anywhere near his mark." Louis A. Strang, Recollections of An Airman (London: J. Hamilton, Ltd., 1933), p. 218.

⁴⁴Antony Fokker, the Dutch inventor, tells this graphic story of the first time he went up to try out his new device. "While I was flying around about six thousand feet high, a Farman two-seater biplane . . . appeared out of a cloud two or three thousand feet below. This was my opportunity to show what the gun would do, and I dived rapidly toward it. The plane, an observation type with a propeller in the rear, was flying leisurely along. . . . Even though they had seen me, they would have no reason to fear bullets through my propeller. While approaching, I thought of what a deadly accurate stream of lead I could send into the plane. . . . I had no personal animosity toward the French; I was flying merely to prove that a certain mechanism I had invented would work. By this time I was near enough to open fire and the French pilots were watching me curiously, wondering, no doubt, why I was flying up behind them. Suddenly I decided that the whole job could go to hell. It was too much like 'cold meat' to suit me. I had no . . . wish to kill Frenchmen for the Germans. Let them do their own killing." Basil H. Liddell Hart, A History of the World War, 1914-1919 (London: Faber and Faber, Ltd., 1934), p. 281.

revolutionary flying gun quickly gave the Germans a superiority in the air which spurred the Allied powers in their search for a still better plane. Until they could match the Fokker, the British and the French resorted to formation flying and sought safety in numbers. At one time in 1916 the British used no less than 12 fighters to escort one observation plane.⁴⁵ The Allies also developed their own interrupter gear to fire their machine guns through the blades of the propellers.⁴⁶

The two best Allied machine guns used in World War I were the Lewis and the Vickers. The Lewis machine gun, which weighed less than 20 pounds without the water jacket (the Lewis was designed to be cooled by water, but experience at high altitudes proved that the difficulty was not in cooling the gun, but in keeping it from freezing), was fed ammunition by magazine. After 47 or 97 shots, depending on the size of the ammunition drum, the empty magazine had to be removed and replaced with a loaded one. A good part of this weapon's efficiency came from

⁴⁵By concentrating on fighter tactics the Allies were able "to seek out their opponents behind the opposing front, thus enabling their own reconnaissance and artillery machines to work undisturbed." Ibid., 282.

⁴⁶In February, 1915, Roland Garros, a famous French aviator, developed a means of firing machine guns through airplane propellers which antedated Fokker's invention. A metal plate clamped to the propeller served to deflect bullets which failed to pass through the whirling blades. After the Germans captured Garros and his plane, they learned the secret of the French successes and adapted this invention to their own use. The French countered with new types of aircraft and tried a number of ingenious schemes to regain aerial superiority. One desperate effort involved a small cage holding a gunner and his weapon which was fastened in front of the propeller. George M. Chinn, The Machine Gun: History, Evolution, and Development of Manual, Automatic, and Airborne Repeating Weapons (Washington: Government Printing Office, 1951), I, 347-348.

its lightness; the gunner had no stable foundation for balance and often worked against terrific wind pressure. The Vickers machine gun was fed from a belt of 500 cartridges, and therefore was more liable to jam whenever the wind could get at the belt. Both the French and British, however, mounted the Vickers up forward with the ammunition belt protected from the wind by a streamlined metal cover. This fixed weapon, operated by the pilot, had the advantage of a big ammunition capacity without the danger of excessive jamming. Both the Lewis and Vickers had a slight margin of speed over other guns, and could fire at the rate of about nine shots per second. Their ammunition was practically the same-- .30 and .303 caliber, respectively.

German pilots fired a fixed Maxim machine gun synchronized to fire through the propeller, and observers were armed with a movable Parabellum machine gun. German aviators had a marked advantage in aerial gunnery because of the greater number of shots they could fire without reloading. (The Parabellum could fire 1,000 rounds before it had to be reloaded.) That is, they could fire so many shots that even if the operator were not a good marksman he could be dangerous.⁴⁷

Aerial machine gun ammunition consisted partly of lead rounds, partly of steel-nosed, armor-piercing bullets, partly of tracer bullets whose phosphorescent trail helped the gunner adjust his fire, and partly of explosive bullets. Each flier chose his ammunition to suit his needs; the general rule was to have about each fifth bullet a tracer round.

⁴⁷ Ibid., 293-323.

The proper answer to the Fokker menace had to be a superior airplane, and the British and French found their efforts rewarded when the De Havilland 2 and the Nieuport, with 110 horsepower engines, proved a match for the Fokker. In preparation for the Somme offensive in 1916, the Allies also improved the strategic use of airplanes, concentrating them in larger formations and carrying the offensive to the enemy. The Germans, in turn, were forced to increase the size of their flying formations and to concentrate their aerial forces for offensive operations.

The Germans, wedded to standard aircraft types, hesitated to make a change. At last, however, they discarded their big monoplane Taubes in favor of their equally standardized Albatros biplanes which gave the observer an unobstructed view. They later developed a gigantic machine with two bodies and two motors and propellers and a car in the middle. It was so powerfully motored that it proved to be speedier than the French and British scouts, but it could neither climb nor maneuver as well as these lesser craft. It was armed with two machine guns.

The Allied air supremacy of 1916 was of short duration. In addition to improved aircraft, the Germans soon developed better methods of fighting, such as the "circus system"--squadrons tactically controlled by picked flying leaders. Oswald Boelcke and Baron Manfred von Richthofen were the leading stars of two of these circuses. Superior training was also a factor which favored German aviation during the war. Although the Allies maintained supremacy in numbers, something like three to one, the Germans made that numerical superiority look smaller

by virtue of their better-trained pilots. The Allies sometimes sent out their pilots wretchedly trained. These, then, were some of the reasons for the inability of the Allies to establish and sustain air superiority for any length of time.⁴⁸

During 1917 the air war grew steadily more intense, individual air battles sometimes involving as many as 100 planes. Operations against enemy air units, either in the air or on the ground, came to be a dominant feature of the air war, with both sides striving to achieve aerial superiority. Fighter pilots became popular heroes in the warring countries as their exploits were reported colorfully by the press. Outstanding among these fliers were George Guynemer, René Fonck, and Charles Nungesser of France; Baron Manfred von Richthofen, Oswald Boelcke, Max Immelmann, Werner Voss, and Herman Göring of Germany; Edward Mannock and Albert Ball of Great Britain; and William A. Bishop of Canada.⁴⁹

Although the fighter plane continued to dominate the air war and the fighter Aces captured the imagination of the public, progress also was made in bombardment, especially during 1917. Army commanders began to see the tactical advantages to be gained by bombing enemy rail

⁴⁸ Cuneo, Winged Mars, II, 280-281.

⁴⁹ Accounts of the exploits of these fliers make up the bulk of the popular literature available for the study of World War I aviation. Although the public seemed pleased with the development of offensive-minded aeronautics, most military commanders were unimpressed. Moreover, all of the famous fighter pilots seem to have shared a common attribute. Along with their courage, daring, and initiative there was invariably a lack of military discipline, a virtue which the commanders demanded. For a list of books dealing with this subject see the section in the bibliography on memoirs, biographies, and personal accounts.

centers and supply depots behind the lines, but it was more difficult for them to appreciate the strategic advantages to be gained from bombardment of transportation and industrial centers farther removed from the battle areas. The Allies, in particular, steadily expanded their bombing operations, organizing special bombardment units and developing larger bombs. In large measure, of course, this was made possible by the air superiority enjoyed by the Allied air forces during most of 1917.

In January, 1915, Kaiser Wilhelm II gave permission to his forces to attack London and other British targets. A few strikes against England had been made by German planes in December, 1914, and there were a few more during 1915, but most of the raids during 1915-1916 were made by Zeppelins. On January 19, 1915, Zeppelins dropped bombs on villages in Norfolk, England, and killed five people. In the first raid on London, May 26, 1915, a single airship dropped a ton of bombs, killing seven people and injuring 35. London was bombed four more times in the latter months of 1915. During 1915-1916, Zeppelins dropped 154 tons of bombs on England, inflicting 1,725 casualties compared with only two tons of bombs dropped by German planes, resulting in 87 casualties.⁵⁰

To meet these attacks the British adopted a variety of measures: 346 planes were assigned to defensive patrol duty; anti-aircraft guns and searchlights were installed around vital centers; and a blackout was adopted in the East Anglica area. These defenses, however, had

⁵⁰ The best source of information about the German air raids on England is Henry A. Jones, The War in the Air, III.

little success against the Zeppelins during most of 1916. The weather proved to be the most effective defense. On January 31, 1916, nine naval Zeppelins attacked targets in the Midlands, killing 59 people at Shrewsbury, England. Four more attacks on Scotland and England during April caused 84 deaths. The first really effective defense against these airships came on September 3, 1916, when the first airship was shot down by a British airplane. More were shot down that same month, and by 1917 the Zeppelin threat had been minimized. With the development of incendiary bullets, the huge, vulnerable gas bags sharply diminished in importance.⁵¹

At the beginning of the war the British had no special artillery for use against hostile aircraft. During the next year their troops in France, unable to ward off enemy airplanes, felt this deficiency keenly. At the same time British planes were suffering more from ground fire than from hostile aircraft. By 1916 the 3-inch field gun had been converted to anti-aircraft use and until the end of the war it remained the standard mobile gun in the zone of operations.⁵²

In France experiments and discussions about anti-aircraft defense dated from 1906. As early as 1910 an anti-aircraft gun had appeared at the annual maneuvers. Yet there was only one such gun in 1914 when the war began. To fill the gap, field guns were set on improvised bases which first permitted an elevation of only 40° but later (1915) 70°. The 75 mm. field guns, stripped of splinter shields and wheels, were mounted on pedestals, but loading them on trucks for

⁵¹ Ibid., 281.

⁵² Ibid., 270-283.

movement to the front was laborious work. France kept the same caliber (75 mm.) throughout the war and did not vary the types to any great extent. Towards the end of the conflict one model was mounted on a trailer and towed by truck.⁵³

At the onset of hostilities, Germany had 13 anti-aircraft guns: six were mounted on trucks; four were mounted on mobile pedestals and drawn by horses; and eight were mounted on traversing carriages and kept in the rear to defend the Rhine bridges and airship hangars. These weapons were augmented by field guns and additional special anti-aircraft artillery pieces. Light field howitzers, which in prewar days had appeared a promising substitute, were used but abandoned early in 1915 because of the slow velocity of their shells. An automatic breech mechanism permitting a 20 to 30 shell per minute rate of fire, higher muzzle velocities, and new shrapnel shells with more explosives and heavier steel balls--all of these were developed during the war.⁵⁴

The development of elaborate weapons and techniques of anti-aircraft defense did not adequately deal with this problem which became more difficult in direct proportion to the improvement of aircraft. New range tables had to be prepared to assure correct fuse settings. Ammunition was a problem; many shells did not explode in the air but fell to earth, sometimes injuring members of the ground forces. Other shells split the gun barrels. There was also the matter of the morale

⁵³ Jean Lucas, "L'aviation et la défense antiaérienne aux premières années de la guerre," Revue des forces aériennes, V (April, 1933), 439-453.

⁵⁴ Neumann, Die Deutschen Luftstreitkräfte im Weltkrieg, pp. 122-127.

of the units. Anti-aircraft fire was seen by thousands of witnesses, every one of whom was a self-appointed critic. Notwithstanding the fact that every shot of an infantryman or artilleryman did not hit an opponent, they heaped abuse and criticism on the anti-aircraft gunners without considering the novelty of the weapon and the practical difficulties of firing at targets moving in three dimensions at high speeds.

Prior to the war, European military leaders had given little attention to the organization and administration of aviation units. The German air service had been collected in part under an Inspector of Airship Troops (lighter-than-air sections) and in part under an Inspector of Aviation Troops (heavier-than-air sections). Both of these were under an Inspector of Military Air and Motor Transport, which in turn was subordinate to the General Inspector of Military Transport. All of these commanders were stationed in Berlin.

When the war came, there was no change except in the division of the troops into mobile units to operate at the front. These sections were placed under the various corps and armies, but no air officers were detailed to go to the front on the various staffs. They stayed in Berlin. The Inspector of Aviation Troops had no connection with the field or fortress aviation sections.

The lack of any staff officers for aviation at the various commands under which the flying sections operated undoubtedly contributed much to the failure of German air reconnaissance to achieve greater results in 1914. No particular officer had the responsibility of assuring the regular issuance of orders and acknowledging the receipt of reports from the airmen. There were no trained men to collect,

interpret, and integrate the air intelligence and to assure its dissemination to all units affected by the information. No one at headquarters understood the capacity and limitations of aircraft. No one curbed the individualism of the leaders of the various flying units which sometimes did more harm than good. There was no intelligent cooperation between the commanders and the aerial observers. This could have been attained if the former had seen to it that the airmen were familiar with the general scheme of maneuver taken by the supporting forces and with the details of the operations.

The defects in the organization were obvious. The General Staff had proposed a remedy in 1912 and 1913 but with no results.⁵⁵ During the first month of the war the Inspector of Aviation Troops submitted a proposal to create a centralized command of all aviation sections at the Oberste Herresleitung. Although the War Ministry initially seemed inclined to approve this suggestion, it met the opposition of both the Inspector of Military Air and Motor Transport and the General Inspector of Military Transport. The old policy was continued.⁵⁶

In October, 1916, the German air service was reorganized to place all air fighting and defense forces of the army under one authority. The entire construction, preparation, and employment of

⁵⁵ Cuneo, Winged Mars, I, 104-106.

⁵⁶ Possibly the general expectation of a short war played a role in this decision. It was believed that the immediate needs of matériel and personnel could be relieved by simpler remedies than a reorganization. Erich von Falkenhayn, General Headquarters, 1914-1916, and Its Critical Decisions (London: Hutchinson and Co., 1919), p. 45. Falkenhayn was the German Minister of War.

aerial units was placed under the General Commanding the Air Forces. General Ernst von Hoeppner, a cavalry officer, was named to this new post, and with the assistance of an excellent staff, he moved the German air force to a position of renewed vigor.⁵⁷

As long as the British air services continued to do well at the front, there was little effort for reorganization. Proposals for the establishment of an Air Ministry submitted in 1914 and 1915 failed to arouse much interest. In the fall of 1915, the Zeppelin air raids culminated in a strike at London by five dirigibles on the night of October 13-14. This attack killed 47 people, wounded 102 others, and caused \$400,100 worth of damage, but no Zeppelin was brought down. The Fokker menace during the winter of 1915-1916 marked the beginning of a movement which finally established the Air Ministry and the Royal Air Force.

The British Joint Air Committee, charged with the responsibility of coordinating the activities of the Royal Flying Corps and the Royal Naval Air Service, ceased to meet after the war began and all central control disappeared. The two services fell into an unseemly scramble for supplies and personnel.⁵⁸ In May, 1916, an Air Board, headed by

⁵⁷ "He took up his appointment at the moment when the German air force was recovering its morale, and his foresight was to ensure that the German airmen were never again to suffer such a spirit of hopelessness as was their fate in the first weeks of the struggle on the Somme." Jones, The War in the Air, II, Appendix VII.

⁵⁸ Raleigh, The War in the Air, I, 472 ff. "[The Chief of Italian Army Aviation] said one thing that struck in my mind, and which made me laugh a good deal internally although I kept an absolutely grave countenance. He said: 'What I am going to say to you will be absolutely unintelligible and unthinkable to you as Englishmen, but I regret to say that here, in Italy, it is a fact that there exists . . .

Lord George N. Curzon, was established. This organization served solely in an advisory capacity for although it had charge of organizing and coordinating the supply of matériel and of preventing competition, it had no authority to institute a policy guiding aircraft orders. Mismanagement, waste, and delay continued.

Early in December, 1916, a new government headed by David Lloyd George came to power. The Air Board was continued and raised to the rank of a War Ministry. A number of other war agencies were revamped to prevent any conflict with the Air Ministry which concerned itself principally with the procurement of aircraft.⁵⁹

In June, 1917, a cabinet committee was set up under Lieutenant General Jan Christian Smuts to consider the problems of air defense and organization. As a result of the report of this committee, the Royal Air Force (Constitution) Act was passed on April 1, 1918. The autonomous Royal Air Force was formed by a merger of the Royal Naval Air Service and the Royal Flying Corps.⁶⁰

In the French air service, the demand for staff officers as air observers greatly exceeded the number available after the war began. Cavalry or infantry officers, pilots not otherwise assigned,

a certain, occasional, shall I say, friction? between the military and naval branches of our Flying Service.' We murmured, 'Impossible.'" Maurice Baring, Flying Corps Headquarters, 1914-1918 (London: W. Heinemann, Ltd., 1930), pp. 104-105.

⁵⁹ Jones, The War in the Air, VI, 2-17.

⁶⁰ The second report of the Prime Minister's Committee on Air Organization and Home Defence Against Air Raids, dated August 17, 1917, in "Birth of the Royal Air Force," Air Power Historian, III (July, 1956), 143-162.

even student officers were employed as substitutes. Six weeks of war completely broke down the old system of divided command (observers under command of army intelligence, pilots under the director of air service) but it was not until December 16, 1914, that an "Instruction on the General Organization and Direction of the Air Service" set up a new system. The army aviation directors became chiefs of the air service and had all the army aviation under their command including the observers. The staff officers were allowed to join the air service to obtain a united system.⁶¹

The chiefs of the air service suffered a decline in importance when escadrilles began to be attached to corps rather than army headquarters and had virtually no authority or control over units serving under these commands.⁶² The experience of a few months of combat brought out some defects in this policy. As division after division and corps after corps was thrown into the battle and the replaced units were withdrawn from the front, the aviation units ordered back and forth often did not have sufficient time at the front to become familiar with the terrain and the situation.

As a result of the problems raised by this decentralization, a new organization was proposed which separated the air service from the ground forces. The zone of operations of each army was divided into

⁶¹The separation of aviation from the Intelligence Section at army headquarters was in some cases too complete. The close liaison that should have continued often evaporated.

⁶²German field aviation units were assigned either to army or corps headquarters. The British organizations tended to follow the pattern of the French and assigned air organizations to lower echelons such as corps or divisions.

air sectors, which usually corresponded to the corps sectors at the front. Each of these air sectors was under a commandant of corps aeronautics who was subordinate to the commandant of army aeronautics.

In each army the air service was under the commandant of army aeronautics. This officer regulated the distribution of all air units, watched over their technical and tactical training and equipment, and assured the concerted action of all the air units of the army. He directly controlled the tactical employment of only the escadrilles and balloon detachments attached to the army headquarters. The remaining air sections, which performed the duties formerly assigned to corps or division escadrilles, were under the commandant of corps aeronautics.

The commandant of corps aeronautics possessed his own staff. It consisted of a balloon officer, a tactical officer, an intelligence officer, and a photography officer. The balloon officer advised the commandant on the performance of balloon units in the zone. The tactical officer assisted the commandant in issuing orders for aviation and balloon missions and in receiving reports on the execution of missions as well as keeping in touch with the corps staffs and commandant of army aeronautics. The intelligence officer, generally an experienced observer, prepared reconnaissance assignments, evaluated the reports, and assured their delivery to the proper infantry and artillery commands. The photography officer assisted in preparing and evaluating photographs. Particular attention was paid to the location of enemy batteries in preparation for preliminary artillery bombardment. He had charge of the photography sections, where the emphasis was on

speed in development and delivery of combat zone pictures. This staff was to ensure the correct employment of the air services in the particular sector.⁶³

When the situation on the western front became one of stabilized warfare, the duties of observation aviation settled into four general missions: the infantry mission, the artillery mission, the reconnaissance mission, and the photographic mission. All of these were performed by both airplanes and balloons and set the pattern for American aerial operations which were carried out later in the war.

The infantry mission was usually viewed with more enthusiasm on the part of the observers than on the part of the infantry. The purpose of the mission was to observe the progress of the infantry advance or to locate the front line elements of infantry battalions in order that the commander might know the location of his combat units. Various means of locating the infantry were attempted, all of which were more or less nullified by the disinclination of the infantry, after their first battle, to let anyone, friend or foe, know where they were. During 1915 the French used flag markers to denote the position of their front lines. It apparently had not occurred to the originator of this scheme that the flags not only marked the lines for the French infantry commander but for the German artillery spotters as well. Later bengal flares were used to mark the front lines, but these, too, were useful for both friend and foe. Finally at Verdun and on the Somme in 1916, panels were carried by the infantry and these arranged

⁶³ Marcel Janeaud, L'aviation militaire et la guerre aérienne (Paris: E. Flammarion, 1923), pp. 62-79.

in code formations on the ground gave the men in the air the information that they wanted at less risk to the men on the ground.⁶⁴

The artillery mission became extremely important early in the war. While the Germans excelled initially in spotting their hits, the British soon developed an extremely efficient aerial artillery observation service.⁶⁵

Artillery reconnaissance missions generally did not require long flights into the enemy's territory. Artillery batteries were located a comparatively short distance behind the lines, and the purpose of this sort of reconnaissance was simply to scout around for new gun emplacements and to see if the Germans had moved from any old ones. This was a difficult assignment, for usually the signs were hard to interpret. Observers had to judge from the color tone of gun pits whether they were occupied or not; the difference was often merely a shade. Any appreciable change in the countenance of a forest gave an immediate sign that a battery was moving and certain kinds of construction work were positive evidence as to the occupation of a firing position. The condition of the paths from nearby dugouts to the emplacements gave additional clues, and sometimes the earth itself would show a burned streak. In the wintertime, a dark smudge on the

⁶⁴Donald MacKain, "Infantry Airplanes and Airplanes of Command," Air Service Bulletin, VIII (October, 1918), 1-2.

⁶⁵For an excellent analysis and collection of pictures illustrating this type of mission see Remarques sur la visibilité de batteries, Bataille de la Somme Front sud de Peronn, juillet-décembre 1916 (Paris: 10e Armée aéronautique, 1917) in the folder marked Observation Material (largely French and some German WWI), in the United States Air Force Historical Division Archives at Maxwell Air Force Base, Alabama. This archives is hereafter referred to as the USAF HD Archives.

ground and melted snow appeared under the muzzle of a gun.⁶⁶

Artillery *réglage*, or spotting artillery fire, consisted of watching the fall of shells on a target and sending back information necessary for the battery to improve its aim. Observers first attempted to point out a target to the artillery by flying over the objective in circles or in figures of eight, or by tossing out paper or tinsel, or by setting off smoke bombs. With such haphazard procedures it is small wonder that many artillery officers were contemptuous of the value of airplanes. In 1915 France adopted a slow but accurate method in which after each salvo the aerial observer dropped at the battery a card which showed graphically where the shots fell. This method was later replaced by radio messages.

Fugitive targets, or, as they were sometimes more aptly called, targets of opportunity, opened the door to a sudden and unexpected bombardment. They required quick cooperation between airplane crew and artillery personnel. For example, if the observer saw a truck convoy proceeding along a road, he directed a battery to fire at it. One 75 mm. gun in each division was to be kept free for action against fugitive targets and was registered on a large number of points in the enemy territory.

Reconnaissance operations conducted in World War I had two main aspects, defense and offense. The reconnaissance routine which the French worked out on the Somme in 1916 will be used as a model, since it included all forms of scouting theory and practice and had to do both with airplane and with balloon observation.

⁶⁶Ibid.

As soon as the staff had decided to launch an offensive, the terrain in front of the army was carefully studied, photographed, and mapped; not simply for a short distance, but far back of the lines. Every enemy trench, every approach, the barbed wire entanglements, machine gun emplacements, headquarters--all of these were repeatedly examined and recorded on countless photographs. Oblique photographs turned up a number of unknown dugouts, and their size suggested how many reserves they could accommodate. All these data were carefully collected and evaluated and as the time for the attack drew near, a large number of photographs, maps, and plans were prepared and issued to commanding officers.

An artillery preparation, based on the intelligence gathered in part by aerial observation, was the prelude to a big offensive. The purpose of this bombardment was five-fold: to cripple the enemy artillery; to smash their machine gun emplacements; to destroy the barbed wire entanglements; to injure the personnel in the enemy trenches as much as possible; and to prevent the reserves from coming up to those trenches. This preparation often continued for several days until the German organization was supposedly crippled, its artillery damaged, and its infantry apprehensive, impatient, and tense. Perhaps the greatest strain in the war was for the infantry to remain under bombardment for a long time without being able to leave the trenches. It was a cruel hardship; the only thing comparable with it was the strain on troops who knew that they would soon be ordered to advance.

When the army was on the defensive, the observer, like other soldiers who had no idea of what would happen next, was apt to be

nervous and uncertain of himself. He had no plan of battle to guide him and he had to take things as they came. He never knew whether some enemy movement was a genuine assault or only a feint.

From the time when the enemy began to prepare for action and the actual advance, the observer's work became almost continuous. He had to learn the direction from which the enemy would attack and all of the information he gathered had to be reported immediately. The enemy's artillery preparation generally was aimed against that part of the front which would be attacked; but there was always the possibility that the enemy would aim its assaults at some other point.

When the enemy was finally halted, the observer then had to discover whether the enemy intended to try another rush. The new front lines and their relationship to the old ones were sketched. When the French infantry was stopped, the French usually dug in at once; but in a similar situation the German infantry invariably moved into the shell holes and used them as the basis of their new system of defense. Photographs showed these matters quickly and clearly, and they also indicated how the lines would have to be oriented and strengthened in order to keep them at least as powerful as the old lines had been.

The reconnaissance mission lost some of its importance when the ground forces reached a stalemate in the first winter of the war. In at least two instances, however, the failure of commanders to utilize their observation aviation to its fullest extent resulted in very critical situations: the lamentable lack of observation in the Dardanelles campaign during the summer of 1915; and in Italy, where the Austrians were permitted to concentrate 12 divisions and 300

artillery pieces near Caporetto without the Italians realizing the magnitude of the concentration. The disaster at Caporetto late in 1917 almost forced Italy out of the war.⁶⁷

With the relative decline in importance of the reconnaissance mission came an increase in the importance of the photographic mission. By the use of aerial photographs and mosaics, both sides could maintain detailed battle maps in a state of almost daily revision. Photographs for mosaics had to be taken while the ship was flying on an even course at a fixed altitude. Aviators sighted along a series of points on the ground and flew in a straight line over the area to be photographed; turned again, and made successive flights while snapping their pictures. The prints were scaled; some were enlarged, some reduced; then they were pasted together, generally over an outline map of the same scale, so that the overlapping parts coincided. The whole mosaic, looking like a jig-saw puzzle, was then photographed, making one picture. The time and energy saved by producing comprehensive, up-to-date maps in this manner was enormous.

Vertical photographs, taken with the camera pointed downward, had no distortion. They were used for general information and for making photographic mosaics and military maps. The oblique photographs, taken not straight down but from an angle, gave a sort of panoramic view which was not of much importance in making war maps but was useful for showing contours and other topographical details which did not show up in vertical photographs. Stereoscopic photography

⁶⁷ Girard L. McEntee, Military History of the World War (New York: Charles Scribner's Sons, 1937), pp. 238; 428-432.

brought out relief features and helped interpreters to estimate height and depth. Unless he were only a few hundred feet high, the aerial observer could tell nothing about the relief of objects on the ground--for example, the depth of trenches. Neither did a regular photograph indicate much about depth. A stereoscopic photograph--two pictures of the same object taken side by side--brought out the missing facts.

At the outbreak of the war Germany and Austria were well equipped for photography; none of the Allies were prepared to perform this specialty. The Germans were first to learn what sort of aerial photographs had value. They soon realized that while 6,000 feet was a high altitude for visual reconnaissance, the telephoto lens could take pictures beyond the range of the best anti-aircraft guns. They were not handicapped, as were the Allies, in securing camera lenses; indeed, before the war Germany and Austria had supplied the world with optical glass. In order to establish her first photographic sections, Britain had to advertise for privately owned lenses and to pay top prices for them. The first British aerial photograph was taken in November, 1914, at Neuve Chapelle. France did not establish her system of allotting one photographic unit to each army until December, 1914; and Britain was a month later in putting the photographic service on an efficient basis. During the first month of operation of a British photographic section in France only 40 negatives were developed.

The French Air Service soon demonstrated that a photograph could be taken over enemy lines, brought back to the airdrome, developed, printed, interpreted, and forwarded to the artillery in as short a time as 15 minutes. This, of course, was a special stunt; but the two hours

regularly required to forward this valuable intelligence was considered satisfactory. By the end of the war, one airplane out of every four on the western front was there solely for photographic service.

CHAPTER III

THE PRE-WAR MILITARY AVIATION EXPERIENCE OF THE UNITED STATES ARMY

Historical Background of the American Air Service

Benjamin Franklin witnessed the first successful free-balloon flight of human beings when he was United States Minister to France in 1783. Fascinated by this and subsequent ascensions, Franklin reported his observations to his scientific friends.¹ Later he suggested some uses for this "new born baby," including the employment of balloons as a means of troop transportation.²

During the spring of 1784, a Paris newspaper reported the ascension of a balloon in Philadelphia on December 28, 1783.³ James Wilcox, a local carpenter, and some animals rode in a cage which was lifted by 47 balloons. There appears to be no evidence to substantiate this story.⁴ In a balloon ascension which took place on July 17, 1784,

¹Letter from Franklin to Sir Joseph Banks, President of the Royal Society in London, dated December 1, 1783, in Leonard Labaree and Whitfield J. Bell, Jr. (ed.), Mr. Franklin: A Selection From His Personal Letters (New Haven: Yale University Press, 1956), pp. 55-58

²See Franklin's letter to Jan Ingerhousz dated January 16, 1784. Ibid., p. 58.

³Journal de Paris, May 13, 1784, p. 585.

⁴Joseph Jackson, "The First Balloon Hoax," Pennsylvania Magazine of History and Biography, XXXV (January, 1911), 51-58; George E. Hastings, "Notes on the Beginnings of Aeronautics in America," American Historical Review, XXV (October, 1919), 68-69.

Peter Carnes, an amateur balloonist of Baltimore, toppled from the basket as his hot air balloon began to rise.⁵

The first successful ascension of a balloon in the United States was made on January 9, 1793, at Philadelphia by the daring French aeronaut Jean Pierre Blanchard. A substantial fund had been subscribed to provide for the exhibition; George Washington, President of the United States, was one of the foremost patrons of the affair. Blanchard's hydrogen balloon rose from the yard of the Walnut Street Prison in Philadelphia and was carried by the wind to land in Deptford Township, New Jersey, 46 minutes later. His initial welcome by the citizens of Deptford was not particularly cordial. Had Blanchard not been armed with a passport furnished him by President Washington it might have been fatal, for none of the Deptford people spoke French and Blanchard spoke no English. Blanchard, however, quickly returned to Philadelphia to be received by President Washington at the Executive Mansion.⁶

Some other Americans were also interested in these early experiments with balloons. As early as February, 1784, Thomas Jefferson was concerned with the problems of military defense and maritime trade which the development of balloons might present.⁷ Jefferson's close friend, Francis Hopkinson, who was initially unconcerned with balloons and unimpressed with their potentialities, facetiously compared the

⁵ Jackson, "The First Balloon Hoax," pp. 51-52.

⁶ Jean Pierre Blanchard, Journal of My Forty-Fifth Ascension, Being the First Performed in America (Philadelphia: Charles List, 1793), pp. 1-10.

⁷ Letter from Thomas Jefferson to Francis Hopkinson, dated February 18, 1784, in Boyd, The Papers of Thomas Jefferson, VI, 542.

flying sphere to a pompous politician--

full of hot air . . . driven along by every current of Wind, and those who suffer themselves to be carried up by them run a great Risk that the Bubble may burst and let them fall from the Height to which a principle of Levity has raised them.⁸

Late in March, 1784, after construction on a balloon had begun in Philadelphia, Hopkinson noted with some contempt the widespread public interest in balloons.⁹ Within two months he became infected with the balloon fever and joined his friends in experiments with hot air balloons;¹⁰ Jefferson, too, was fascinated with the novelty.¹¹

The use of the military balloon by the United States Army was first proposed during the Seminole War. On September 3, 1840, Colonel John H. Sherburne, who had first-hand experience in Florida, wrote to the Secretary of War, Joel Poinsett, that the protracted effort to ferret out these Indians for removal to the West might be expedited by the use of balloons. The semitropical jungles and wilderness terrain of Florida made it most difficult to surprise, surround, and defeat the Indians. A sketch and simple plan of nocturnal ascensions and

⁸ Letter from Francis Hopkinson to Thomas Jefferson, dated March 12, 1784, ibid., VII, 20.

⁹ "The Name of Congress is almost forgotten, and for one Person that will mention that Respectable body a hundred will talk of an Air balloon. I have a singular Regard for Congress and will therefore ask an unfashionable Question. When may we hope to see Congress that Way, and what are they doing? But I grow saucy and have not Time now even for that." Letter from Francis Hopkinson to Thomas Jefferson, March 31, 1784, ibid., p. 57.

¹⁰ Letter from Francis Hopkinson to Thomas Jefferson, May 12, 1784, ibid., p. 246.

¹¹ Letter from Thomas Jefferson to James Monroe, dated May 21, 1784, ibid., p. 280.

reconnaissance followed by daylight assaults was presented. The wheels of the War Department turned slowly and although the matter was subjected to a considerable amount of consultation and coordination, nothing in the way of final decision or new action took place before the war was brought to a close.¹²

In 1846, during the Mexican War, John Wise of Lancaster, Pennsylvania, proposed the use of a captive balloon secured to a warship as a means for the aerial bombardment of Fort San Juan de Ulúa, which guarded the harbor of Vera Cruz.¹³ During the latter part of the year the War Department was involved with the formulation of a plan of attack on this formidable point. Wise sought to show how the use of an aerial weapon would reduce costs in money and lives. The War Department pigeonholed his suggestion and even neglected to answer it. Finally it was decided to take Vera Cruz by landings near the port and land assaults on the city rather than attempt to knock out the fortress and invade from the sea.¹⁴

In 1859 John Wise and some companions flew from St. Louis, Missouri, to Henderson, New York, a distance of 1,100 miles, in less than 20 hours.¹⁵ Other long-distance flights were not always so

¹²Frederick S. Haydon, "First Attempts at Military Aviation in the United States," Journal of the American Military History Foundation, II, No. 2 (Summer, 1933), 132-135.

¹³John Wise, System of Aeronautics (Philadelphia: Joseph A. Speel, 1850), p. 257.

¹⁴Justin H. Smith, The War With Mexico (New York: Macmillan Co., 1919), I, 349-355.

¹⁵This established a record not equalled until 1910.

successful. Later that same year two balloonists took off from Watertown, New York, and were blown in their balloon 300 unscheduled miles into the wilderness of Canada. They were lost in the forest for nearly a week but were finally rescued by a party of lumbermen.¹⁶

Balloonists were interested in an aerial crossing of the Atlantic Ocean throughout the nineteenth century. In 1844 Edgar Allen Poe, in a celebrated hoax printed in a New York newspaper, announced the accomplishment of this enterprise.¹⁷ A number of aeronauts announced their intentions of undertaking the voyage and prevailed upon Congress to appropriate funds for a trans-Atlantic flight. No Federal funds, however, were set aside for these visionary schemes. In 1858 the completion of the laying of a trans-Atlantic telegraph cable by Cyrus Field initiated new interest in transoceanic flights. Some large balloons were built and tested but none of them made the flight.¹⁸

The Union armies adopted the balloon early in the Civil War, using it at the First Battle of Bull Run, in 1861. Thaddeus S. C. Lowe, a civilian employed by the Army of the Potomac, made a free balloon flight after the defeat of the Union Army and was able to observe and to report the Confederate advance.¹⁹ During the reorganization of the Union Army following Bull Run he made daily ascensions to

¹⁶ New York Herald, September 29, 1859; p. 1; October 6, 1859, p. 9.

¹⁷ New York Sun, April 13, 1844, p. 1.

¹⁸ Some balloon enthusiasts persisted in their ambition to cross the Atlantic to Europe. Samuel A. King, "How to Cross the Atlantic in a Balloon," Century Magazine, LXII (October, 1901), 356-359.

¹⁹ Frederick S. Haydon, Aeronautics in the Union and Confederate Armies (Baltimore: Johns Hopkins Press, 1941), I, 192-193.

check the Confederate dispositions.²⁰ Professor Lowe, as Chief Aero-naut, organized the first American Balloon Service, responsible only to Major General George McClellan, with one Army captain, 50 noncommissioned officers and privates, and a number of volunteer civilian observers to assist him.²¹ His equipment consisted of four balloons, two horse-drawn gas generators, and an acid cart for charging the gas generators.

In the Peninsular Campaign against Richmond in 1862, observation balloons were used extensively, with varying success. Aside from reports of enemy deployment and activity, another function of the balloon service was the direction of artillery fire.²² During the siege of Yorktown, the holding cable snapped while Major General Fitz-John Porter, an adventurous Union corps commander, was engaged in his observation, and but for a favorable wind he would have come down behind the Confederate lines.²³

In the campaign around Richmond in the spring of 1862 the Union Army made effective use of its balloons. On the first day of the attack at Seven Pines a telegraph key was taken up in one of Lowe's balloons and a cable dropped to a ground telegraph line. For some reason, however, the connection was placed not in the command post, but

²⁰ Ibid., pp. 204-205.

²¹ Ibid., pp. 280-303.

²² Ibid., pp. 322-324.

²³ War Department, War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies (Washington: Government Printing Office, 1899), Series 3, Volume III, p. 274. Hereafter cited as Official Records with the series number preceding the title.

in the War Department office in Washington. The congressmen and senators assembled there were thus privileged to get battlefield reports from the front before the Commanding General received them. What value this particular arrangement was to Congress or to the prosecution of the war remains a mystery.²⁴

A copy of a report of one of McClellan's observers, John La Mountain, who on August 10, 1861, made two ascensions to 3,500 feet over an area over the Yorktown peninsula in Virginia is of interest. His sketch shows several Confederate bivouacs, near Hampden, Newport News, and Pig Point and reports the number and type of ships near Norfolk and in the James River.²⁵ An observation mission from a modern airplane could hardly have given better information, and La Mountain's reconnaissance report must have been most welcome to McClellan's staff.

On June 1, 1862, Chief Aeronaut Lowe, observing from an altitude of 1,100 feet, reported the formation of a large counter-attacking force about to attack near Fair Oaks. Unknown to the Confederates, McClellan was able quickly to mass to meet this attack and defeat it.²⁶ At Fredericksburg in November of the same year, however, Major General Ambrose Burnside was misled by reports of his balloon observers and foolishly attacked General Robert E. Lee,

²⁴Haydon, Aeronautics in the Union and Confederate Armies, I 325.

²⁵Reproduction of one of the Earliest Reconnaissances, Reported by John La Mountain, Aeronaut, August 10, 1861 (Copied from the Original in the Old Records Section, Office of the Adjutant General), in the USAF HD Archives.

²⁶3, Official Records, III, 279-281.

believing erroneously that over half of Lee's army was at a considerable distance from Fredericksburg. The Confederates exhibited little fear of the Union balloons. As the special correspondent of the London Times noted at Fredericksburg, "The experience of twenty months' warfare has taught them how little formidable such engines of war are."²⁷

In the same wooded terrain six months later

No less than three captive balloons, in charge of skilled observers looked down upon the Confederate earthworks. Signal stations and observatories had been established on each commanding height; a line of field telegraph had been laid from Falmouth [General Joseph Hooker's command post] to United States Ford, and the Chief of Staff, [Dan] Butterfield, remained at the former village in communication with General Sedgwick. . . . It seemed impossible . . . that a single Confederate battalion could change position without both Hooker and Sedgwick being at once advised.²⁸

But in the early morning of May 1, 1863, river mists rose over the Chancellorsville battlefield, Hooker's observation was blinded, and the next day Stonewall Jackson made his famous flank march to strike Hooker's right and gain one of the outstanding Confederate victories of the war.

Soon thereafter the Balloon Corps was transferred to the control of the Signal Corps. When the Signal Corps commander, Colonel Albert J. Meyer, was unable to secure the men and matériel he deemed necessary, he recommended that the Balloon Corps be abolished. His suggestion was acted upon and the Balloon Corps was discontinued in June, 1863.²⁹

²⁷ London Times, January 1, 1863, p. 9.

²⁸ George F. R. Henderson, Stonewall Jackson and the American Civil War (New York: Grosset and Dunlap, 1943), p. 655.

²⁹ Charles D. Chandler and Frank P. Lahn, How Our Army Grew Wings (New York: Ronald Press, 1943), pp. 37-38.

After this disbandment of the balloon corps in June, 1863, a hiatus of almost 30 years followed, during which the United States government manifested virtually no interest in aeronautics. In 1887, Brigadier General Adolphus W. Greely,³⁰ who had been impressed by the balloons employed during the Civil War, was appointed Chief Signal Officer and initiated a new interest on the part of the United States Army in aeronautics.³¹

One of General Greely's first moves towards the resurrection of military aviation was to send to France for a balloon. The General Meyer,³² which Greely's agents procured in France, was flown at the Columbian Exposition in Chicago in 1893; later the balloon was sent to Fort Logan, Colorado, where it was used for training purposes. About this same time, Ivy Baldwin, a professional aeronaut, enlisted as a sergeant to have charge of the balloon. By 1896, however, it was worn out and had to be discarded. Sergeant Ivy Baldwin and his wife constructed the next United States Army balloon.

During the Spanish-American War, fought during the summer of 1898, First Lieutenant Joseph E. Maxfield of the Signal Corps was put in charge of balloons for the expeditionary force. Despite the confusion and disorder at Tampa, Florida, Lieutenant Maxfield assembled

³⁰ The story of Greely's experiences in the arctic during the first International Geophysical Year are vividly recounted in A. L. Todd, Abandoned (New York: McGraw-Hill Book Co., 1961).

³¹ Russell J. Parkinson, "United States Signal Corps Balloons, 1871-1902," Military Affairs, XXIV (February, 1961), 197.

³² This was an ironic name for the balloon in view of the 1863 recommendation of Col. Albert J. Meyer that the United States Army discontinue the use of balloons.

his men and equipment and embarked for Cuba on the Rio Grande.

Maxfield was not granted permission to unload his troops or supplies for six days after the invasion force had disembarked at Daiquiri. Once ashore it was discovered that the balloon had been damaged by heat, moisture, and rough handling. Regardless of the fact that the balloon was unfit for safe operation, three ascents were carried out on June 30, 1898. The presence of Admiral Cervera's fleet in Santiago harbor was definitely confirmed and information on the terrain was supplied to the commander of the ground force, General William Shafter.

On the next day, July 1, 1898, against Maxfield's advice, the balloon, carrying Lieutenant Colonel George Derby, Shafter's chief engineering officer, was hauled to an open field in the rear of troops waiting to assault San Juan Hill. The commanders benefited from the reports of the observers. The reopening of artillery fire was suggested and routes of advance were spotted. Infantry troops, however, did not welcome the extra attention given their area of the battlefield by the Spanish gunners who directed a stream of fire at the balloon. In a short time the balloon was so riddled by Spanish shot that it came floating down with its passenger, Colonel Derby, never receiving a scratch.³³ The United States Army balloon service was discontinued in 1899, after the Spanish-American War.

³³A very readable account of these balloon activities is included in Walter Millis, The Martial Spirit: A Study of Our War With Spain (Boston: Houghton Mifflin Co., 1931), pp. 280-286; and Frank Freidel, The Splendid Little War (Boston: Little, Brown and Co., 1958), pp. 147-151.

The Signal Corps, under the leadership of Generals Adolphus W. Greely and James Allen, who succeeded Greely as Chief Signal Officer in 1905, maintained an active interest in military aeronautics. Not only did the Signal Corps seek to promote the observation balloon but it also encouraged Dr. Samuel P. Langley in his aeronautical research. The leaders of the Signal Corps called attention to developments along this line at home and abroad, and urged the adoption of appropriation measures which would enable the army to take full advantage of aeronautical experimentation as related to military reconnaissance.³⁴

At the turn of the century interest in military aeronautics was enhanced somewhat by the experimentation of Langley and the Wright brothers and the rise of ballooning as a sport. The latter was evidenced by the activities of the newly organized Aero Club of America which, however, was interested as well in the more serious business of helping to promote the progress of aviation in general. A small balloon detachment took part in the army maneuvers in 1902, but was discontinued

³⁴ A general substantiation for the summary statements about the military aviation experience of the United States before her entry into World War I may be found in the annual reports of the Chief Signal Officer. For more specific references see: Clayton Bissell, Brief History of the Air Corps and Its Latest Developments (Fort Monroe, Va.: Coast Artillery School Press, 1928), pp. 3-9; Chandler and Lahn, How Our Army Grew Wings, pp. 12-178; Arthur Sweetser, The American Air Service: A Record of Its Problems, Its Difficulties, Its Failures, and Its Final Achievements (New York: D. Appleton and Co., 1919), pp. 1-11 (hereafter cited as The American Air Service); and Lloyd Morris and Kendall Smith, Ceiling Unlimited: The Story of American Aviation From Kitty Hawk to Supersonics (New York: Macmillan Co., 1953), pp. 145-159 (hereafter cited as Ceiling Unlimited). Brief accounts accompanied by appropriate pictures are found in A Chronicle of the Aviation Industry in America, 1903-1947 (Harrisburg, Pa.: J. Horace McFarland Co., 1948), pp. 7-18; Historical Office of the Army Air Forces, The Official Pictorial History of the AAF (New York: Duell, Sloan and Pearce, 1947), pp. 21-35; and Alfred Goldberg (ed.), A History of the United States Air Force, 1907-1957 (Princeton: D. Van Nostrand Co., Inc., 1957), pp. 2-11.

shortly thereafter. During the spring of 1907 the Signal Corps purchased a balloon from the Louis Godard firm in Paris, and in June detailed two enlisted men to aeronautical duty.

On August 1, 1907, General James Allen, Chief Signal Officer of the United States Army, announced the creation of an Aeronautical Division within the Signal Corps. This unit was set up to handle all matters relating to "military ballooning, air machines, and all kindred subjects." Captain Charles Chandler, who had long been interested in military aeronautics, was appointed as head of the new division.³⁵

Captain Thomas S. Baldwin built the first dirigible balloon for the United States Army. During its testing in 1908 its average speed was 19.6 miles per hour in a two hour flight. This dirigible was used for exhibitions and training for four years, before it was sold. In 1908 balloon detachments were set up at Fort Myer, Virginia, and Fort Omaha, Nebraska. During that same year Major Edgar Russell, Captain C. S. Wallace, and First Lieutenant Frank P. Lahm experimented with radio and received messages at altitudes up to 3,600 feet.

Influenced by the work of Samuel Langley and the Wright brothers, the Army's interest in aeronautics turned chiefly to the heavier-than-air machines and controlled powered flight. The first flight for the United States Army took place at Fort Myer, Virginia, in the fall of 1908. The machine, for which the Wrights had been allowed but \$25,000, surpassed War Department specifications. It flew faster than 40 miles

³⁵ A facsimile of the Allen memorandum of August 1, 1907, is reproduced in Samuel T. Moore, U.S. Airpower: Story of American Fighting Planes and Missiles from Hydrogen Bags to Hydrogen Warheads (New York: Greenberg, 1958), plate no. 5 facing p. 20. This work cited hereafter as U.S. Airpower.

an hour and carried enough fuel for a flight of 125 miles. Carried out successfully under official auspices, the Fort Myer tests, which at the time were considered to have been rather rigid, created much more of a stir than the flight at Kitty Hawk five years earlier. Enthusiasm was aroused to a hysterical pitch and the newspapers could scarcely find sufficient praise for the new war tool. A few days after the first tests came a tragic awakening. On September 17, 1908, Orville Wright took off from Fort Myer with First Lieutenant Thomas E. Selfridge as a passenger, and as a result of a guy wire fouling a propeller the plane crashed, killing Selfridge and injuring Wright severely. It was evident that although flying was an accomplished fact, aviation was in its rude beginnings and the men who went into the air had to face grave risks. It was not until after the final test in August, 1909, that the War Department acquired its first airplane.

As part of their original contract with the War Department, the Wrights had agreed to teach two officers to operate the machine. In October, 1909, Wilbur Wright trained Lieutenants Frank P. Lahm and Frederic E. Humphries at a field at College Park, Maryland. Shortly after performing solo flight, both of these officers were ordered to return to their regular duties, Lahm to the cavalry and Humphries to the engineers, leaving the Signal Corps with no qualified pilot.

First Lieutenant Benjamin Foulois, who had received some unofficial flying training from Wilbur Wright, was placed in charge of the Army's plane, which was moved to Fort Sam Houston, Texas, where the winter weather would allow more flying. Foulois learned to fly by a bit of training, by correspondence with the Wrights, and by trial and

error. Until 1911 Lieutenant Foulois was the only pilot in the United States Army.

The Aeronautical Division Aviation School at College Park, Maryland, under the command of Captain Charles Chandler, began its training operations in the summer of 1911. A number of officers learned to fly at this school. Experiments in aerial photography from an airplane were also conducted. During the winter months the school operated at Augusta, Georgia, and in the winter of 1912-1913 part of the aviation school went to San Diego, California, for further training. In addition to this detachment two overseas training schools were established; one in the Philippines, and one in Hawaii. Between March, 1913 and 1914, Lieutenant Frank P. Lahm trained several pilots at a successful school at Fort William McKinley near Manila.³⁶ Lieutenant Harold Geiger was less successful in his efforts to operate a pilot-instruction center at Fort Kamehameha in Hawaii. During the latter months of 1913, the lack of facilities and difficulties with the wind-swept terrain added to the problems he had with his seaplanes caused Lieutenant Geiger to give up his enterprise.³⁷

In December, 1913, the Signal Corps decided to consolidate its training activities and established the Signal Corps Aviation School on North Island near San Diego, California. In addition to pilot training the Army initiated ground training for the nonflying specialists needed

³⁶Report of the Chief Signal Officer in U.S. War Department, Annual Report, 1914 (Washington: Government Printing Office, 1914), I, 524.

³⁷Ibid.

to operate airplanes. Distinguished aviation scientists from the Smithsonian Institution, skilled engineers from private industry, and meteorologists from the United States Weather Bureau were brought in to supplement the instruction conducted by this school.³⁸

On July 18, 1914, Congress established the Aviation Section of the Signal Corps with an authorized strength of 60 officers and 260 enlisted men. It was

charged with the duty of operating or supervising the operation of all military aircraft, including balloons and aeroplanes, all appliances pertaining to said craft; also with the duty of training officers and enlisted men in matters pertaining to military aviation.³⁹

The act limited officers to unmarried lieutenants of the line, provided for flying pay, and established the aeronautical ratings of Junior Military Aviator and Military Aviator.⁴⁰

Experience in Aerial Observation

The first artillery direction missions to be flown by United States Army airplanes were performed in November, 1912. The planes ordered the fire of the batteries to the targets, located the hits, and forwarded the necessary corrections. The aerial observers communicated with the ground batteries by radiotelegraphy, by dropped messages, and by smoke signals. Although the signaling techniques were crude and subject to error, it was found that planes flying at 2,000 feet could locate targets that could not be found in any other way.⁴¹

³⁸ Ibid., p. 517.

³⁹ Ibid., p. 514.

⁴⁰ Ibid., p. 515.

⁴¹ War Department, Annual Report, 1913, I, 781-782.

Airplanes flown by a small detachment of pilots from College Park, Maryland, took part in the maneuvers conducted in the vicinity of Bridgeport, Connecticut, in August, 1912 and 1913. Although fliers were ordered to perform aerial reconnaissance from a height of over 2,000 feet, they were fairly successful except when the inclement weather limited visibility. It was impossible to carry observers in the old machines used except under the most favorable conditions and it was necessary for most pilots to perform their own observation.⁴²

When the United States did not recognize the revolutionary government which General Victoriano Huerta had set up when he seized power on February 22, 1913, a tense situation developed between America and Mexico. Later that same month, the 1st Aero Squadron (Provisional), under the command of Captain Charles Chandler, was ordered to report to Texas City, Texas, for service with the 2d Division of the United States Army. In Texas, Captain Chandler assembled his small force of seven airplanes, seven pilots, and a handful of administrative personnel and mechanics, and early in March, 1913, began to prepare his unit for action. For three and a half months the 1st Aero Squadron trained with ground forces, gained valuable experience in liaison and reconnaissance, and made a number of long-distance flights. Fortunately, hostilities did not break out with Mexico and aviation was not put to the test of combat.

United States relations with Mexico again became strained following the Tampico incident in April, 1914.⁴³ The 1st Aero Squadron,

⁴² War Department, Annual Report, 1912, I, 968.

⁴³ American sailors landing in the town of Tampico were

no longer a provisional organization, under the command of Captain Benjamin Foulois, sent a detachment of five officers and three airplanes to Galveston, Texas, to join the United States expedition against Vera Cruz. The transports sailed before the detachment arrived and the planes, never unpacked, returned with the detachment in July, 1914.

During 1915 Pancho Villa and his Mexican bandits engaged in a number of across-the-border raids into Texas and New Mexico. Another detachment, again from the 1st Aero Squadron, was sent to Brownsville, Texas, in April, 1915. Lieutenants Thomas Milling and Byron Q. Jones, the pilots of this detachment, flew over the border area and were fired on by Villa's men. A number of reconnaissance missions were flown but the planes suffered mechanical difficulties and were mostly undependable.

Early on the morning of March 9, 1916, a band of Pancho Villa's Mexican desperadoes raided Columbus, New Mexico, killing a number of American soldiers and civilians. A punitive expedition under the command of Brigadier General John J. Pershing was ordered to cross the border and capture Villa. The 1st Aero Squadron, under the command of Captain Foulois, arrived at Columbus on March 15, 1916. In May, 1916, when it reached its maximum strength, this unit was made up of 16 officers and 122 enlisted men.

temporarily taken into custody. Though they were released "with regrets," their commanding officer asked for an apology in the form of a 21-gun salute. Huerta refused and thus became the champion of Mexican sovereignty against the foreign aggressor. Unable to get arms in America to fight his northern enemies, Huerta was dealing with German agents at a time when world opinion was anti-German. The United States, offended by the refusal to salute in apology, and determined to prevent the delivery of a cargo of guns from a German vessel, occupied Vera Cruz harbor.

On a flight from Columbus, New Mexico, to an advanced base at Casa Grandes, Mexico, on March 19, 1916, one airplane turned back, one cracked up in a forced night landing, and the other six were forced down in the darkness. This first mission was symptomatic of the trend toward failure that dogged the 1st Aero Squadron throughout the Mexican expedition. The soaring heights of the Sierra Madre Mountains, gusty gales, dust, and heat kept the rickety airplanes from being useful machines during the summer of 1916. On one occasion, Captain Foulois, who had landed at Chihuahua City to deliver dispatches to the American consul, was arrested and jailed. He was released but meanwhile a crowd of Mexicans had mutilated his plane, burning holes in the wings with cigarettes, slashing the fabric, and removing some of the nuts and bolts. Foulois was able to fly back to his landing field.⁴⁴

By April 20, only two of the original eight airplanes were still operational. They were taken to Columbus, condemned, and destroyed. Not one of the 12 replacement planes proved to be any more serviceable than the earlier ones.⁴⁵ Short flights in good weather, with mail and dispatches, appeared to be about all that could be expected. The 1st Aero Squadron continued to be based at Columbus until early 1917, but its operations over Mexico diminished after the summer of 1916.

The commander of the American punitive expedition to Mexico, Brigadier General John J. Pershing, was not pleased with the aviation

⁴⁴Harry A. Toulmin, Jr., With Pershing in Mexico (Harrisburg, Pa.: Military Service Publishing Co., 1935), p. 122.

⁴⁵Report of the Chief Signal Officer in the War Department, Annual Report, 1916, I, 88.

service. He felt that the presence of even one dependable scouting plane would have served to prevent a number of needless deaths of American soldiers. A well-trained group of aviators provided with an up-to-date fleet of planes undoubtedly would have been of value in reconnoitering the sparsely settled wastelands of northern Mexico. Pershing made no criticism of his aviators; their daring and courage evoked his "most enthusiastic admiration," but he was not pleased with the performance of their antiquated aircraft.⁴⁶

In comparison with the aerial operations which were going on in Europe at the same time, the efforts and accomplishments of the 1st Aero Squadron in the Mexican punitive expedition were most unspectacular. In spite of its poor experience in military aviation, when the United States entered World War I in April, 1917, she was committing herself to action in the air as well as on land and sea.

⁴⁶ John J. Pershing, My Experiences in the World War (New York: Frederick A. Stokes Co., 1931), I, 159-160.

PART II

ORGANIZATION OF THE UNITED STATES AIR SERVICE
IN WORLD WAR I

CHAPTER IV

AIR SERVICE ORGANIZATION IN THE UNITED STATES

Problems of Organization

When the United States declared war on Germany on April 6, 1917, the strength of the Aeronautical Division of the United States Army's Signal Corps stood at 131 officers and 1,087 enlisted men.¹ These were distributed roughly into seven squadrons. The 1st Aero Squadron, fully organized, was located at Columbus, New Mexico; the 2d Squadron was divided between San Diego, California, and the Philippines. The 3d, 6th, and 7th were being organized at San Antonio, Texas, Hawaii, and Panama, respectively. The two remaining squadrons, the 4th and 5th, were in the process of being organized, but were being used as detachments in operating the flying schools.² The Signal Corps Aviation Schools at Mineola, Long Island, New York, and San Diego, California, were in operation as primary flying schools of the Regular Army. A school at Essington, Pennsylvania, had just been

¹ Sweetser, The American Air Service, p. 54; George W. Mixter and H. H. Emmons, United States Army Aircraft Production Facts, Compiled at the Request of the Assistant Secretary of War, January, 1919 (Washington: Government Printing Office, 1919), p. 5. Hereafter cited as United States Army Aircraft Production Facts.

² U.S., War Department, Order of Battle of the United States Land Forces in the World War, American Expeditionary Forces (Washington: Government Printing Office, 1949), III, Part 2, pp. 998-999. Hereafter cited as War Department, Order of Battle.

opened for National Guard instruction, and Glenn Curtiss was operating civilian schools at Newport News, Virginia, and Miami, Florida, for the instruction of 125 reserve aviators.³

It is difficult to determine how many planes were in the service on April 6, 1917, but on the previous January 5, there were 73 planes on order but not yet delivered. The Army had only 55 training planes in service at the outbreak of the war, all of them entirely without war equipment and valueless for service at the front. Of these 55 planes, the National Advisory Committee for Aeronautics, which was conducting a scientific study of the problems of flight, advised that 51 were obsolete and the other 4 obsolescent. There were no bombers, no fighters, and no service planes.⁴

None of the Army pilots had received any training that would fit them for combat duty. Only six Aeronautical Division officers had any experience in the organization of personnel and matériel, or in the tactical employment and coordination of aerial units with ground troops. Five aviation officers had been given technical training as aeronautical engineers.

The balloon personnel of the Aeronautical Division at the

³Ibid., Part 1, p. 93. The National Guard contained no aviation units although the 1st Aero Company, New York National Guard, organized in 1916, had received provisional recognition as the 1st Reserve Aero Squadron before it was disbanded in May, 1917. A second New York National Guard squadron was in the process of organization before the outbreak of the war, but no Reserve Corps units proper had been created. Ibid.

⁴Leonard P. Ayres, The War With Germany: A Statistical Summary (2d ed. rev.; Washington: Government Printing Office, 1919), p. 85; Benjamin D. Foulois, "The Air Service, American Expeditionary Forces, 1917-1918," 1924, p. 1, in Foulois Collection, USAF HD Archives.

outbreak of the war consisted of approximately six officers and 50 enlisted men. The United States Army possessed three serviceable free balloons and two captive balloons. The only facilities for balloon training were at a balloon school at Fort Omaha, Nebraska.⁵

Advisory Organizations

Several technical boards, committees, and councils furthered the development of the United States Air Service by their investigations, research, and advice. The more important of these organizations were: the National Advisory Committee for Aeronautics; the Aircraft Production Board; the Aircraft Board; the Joint Army and Navy Technical Aircraft Board; the National Research Council; and the War Industries Board.

The National Advisory Committee for Aeronautics was established by the Naval Appropriation Act of March 3, 1915. During the war the Committee investigated the condition of the aircraft industry; made recommendations to the War and Navy Departments for increasing the quality production of aircraft; recommended the creation of the Aircraft Production Board; made available to that Board information acquired by the Committee from a census of the production facilities of manufacturers of airplane engines; and took the initiative in organizing ground schools for aviators. It acted as a clearinghouse for inventions submitted to the Army and Navy, and as a source of

⁵Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1389.

general information for the aircraft industry.⁶

The first step toward the formation of the Aircraft Production Board was taken on April 12, 1917, when the National Advisory Committee for Aeronautics urged the Council of National Defense to appoint such a board.⁷ Because of its many wartime duties, the Council did not establish the Aircraft Production Board until May 16, 1917. This organization was given no legal powers but was authorized by the Council, itself an advisory body, to offer advice to both the Army and the Navy as to the quantity production of aircraft and on problems of engineering, specifications, standardization, inspection, schools, supply depots, and priority--in short, anything that would tend to provide adequate matériel. Howard E. Coffin, one of the founders of the Hudson Motor Car Company, was made chairman and organizer of the new board. Brigadier General George O. Squier, Chief Signal Officer of the Army,⁸ and Admiral David W. Taylor, Chief of the Construction and Repair Bureau of the Navy Department, were chosen to represent the Army and Navy. Three prominent civilian industrialists, Edward A. Deeds,

⁶ Report of the Chief Signal Officer in War Department, Annual Reports, 1917, I, 838; Claussen, "Matériel Research and Development in the Army Air Arm, 1914-1945," USAF Historical Study No. 50, 1946, chap. i, in USAF HD Archives.

⁷ U.S., National Advisory Committee for Aeronautics, Third Annual Report of the National Advisory Committee for Aeronautics (Washington: Government Printing Office, 1918), p. 17.

⁸ Squier, one of the few officers to have taken a Ph.D. degree after graduating from West Point, was a distinguished scientist and an air enthusiast. He flew in the Wright aircraft during the Army's acceptance test in 1908. Early in World War I he served as military attaché with the British Army and returned to America full of enthusiasm for employing airplanes in combat. He was appointed Chief Signal Officer on February 14, 1917.

President of the Delco Company; Robert L. Montgomery, a member of a Philadelphia financial concern; and Sidney D. Waldon, former Vice President of the Packard Motor Car Company, completed the membership of the board.⁹ It considered matters relating to quantity production of aircraft and cooperated with the Army and Navy in the advancement of their aviation programs. It was discontinued on October 1, 1917, and its functions were taken over by the Aircraft Board.

The Aircraft Board was created on October 1, 1917, and consisted of nine members, including the same representatives of the War and Navy Departments as the Aircraft Production Board. It acted in an advisory capacity for the Chief Signal Officer and the Naval Aviation Officer relative to the purchase and production of aircraft, made recommendations as to contracts for aircraft and the distribution of contracts, and served as a clearinghouse for aeronautical information for the Army and Navy.¹⁰

In April, 1917, Secretary of the Navy Josephus Daniels proposed to Secretary of War Newton D. Baker the organization of a Joint Army Navy Technical Aircraft Board, for the purpose of standardizing designs and general specifications of all aircraft except "zeppelins." Daniels nominated for membership Lieutenants Arthur K.

⁹ U.S., War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918 (Washington: Government Printing Office, 1922), pp. 36-37.

¹⁰ Irving B. Holley, Ideas and Weapons: Exploitation of the Aerial Weapon by the United States During World War I. A Study in the Relationship of Technological Advance, Military Doctrine, and the Development of Weapons (New Haven: Yale University Press, 1953), p. 68. This work hereafter cited as Ideas and Weapons.

Atkins, John H. Towers, and Assistant Naval Constructor Jerome C. Hunsaker, Jr., all of the United States Navy.¹¹ On May 5, 1917, Secretary Baker agreed to the formation of such a board, naming Captains Virginius E. Clarke, Benjamin D. Foulois, and Edgar S. Gorrell as Army members. Although this board was constituted as an advisory agency, its authority was strengthened tremendously on May 29, when the Chief Signal Officer announced that no aircraft specifications would be issued until approved by the Joint Army Navy Technical Aircraft Board; no specifications for aircraft would be sent to any manufacturer for comment until the board had sanctioned them.¹²

The National Research Council was originated in 1916 by the National Academy of Sciences.¹³ Membership comprised the chiefs of the technical bureaus of the War and Navy Departments, the heads of other Government bureaus engaged in scientific research, and representatives of educational institutions, research foundations, and engineering and industrial research. This body conducted some investigations in aeronautics. The Science and Research Division of the Signal Corps was established upon its recommendation.¹⁴

¹¹Archibald D. Turnbull and Clifford L. Lord, History of United States Naval Aviation (New Haven: Yale University Press, 1949), p. 110.

¹²William F. Willoughby, Government Organization in Wartime and After: A Survey of the Federal Civil Agencies Created for the Prosecution of the War (New York: D. Appleton and Co., 1919), chap. xiv.

¹³Ibid., p. 22.

¹⁴A vice-chairman of the National Research Council, the distinguished physicist Robert A. Millikan, accepted a commission as lieutenant colonel and took command of the Science and Research Division in 1918.

The War Industries Board was created by the Council of National Defense on July 28, 1917, as a clearinghouse for government industrial needs. On May 28, 1918, the Board was made a separate agency by Executive Order Number 2868. This Board, headed by the shrewd and forceful Bernard M. Baruch, was responsible for maintaining a balance between industry and government while expediting the production of all things needed to fight the war. Under circumstances which made materials scarce, used up the limited supply of machine tools, and restricted the labor market, the delays that slowed the war effort would have been far more serious if the "Baruch Board," as it was known, had not shortened them by prompt decisions and vigorous pronouncements. The Board assisted the Air Service by the coordination of all government needs, adjustment of prices, establishment of priorities with respect to commodities required, and the solution of industrial problems.¹⁵

Initial Steps

Within the War Department the General Staff, which had no real experience in aerial warfare, was busy with more familiar problems. The Signal Corps, under pressure to produce results, expanded the Aeronautical Division quickly and reorganized it into a number of divisions,¹⁶

¹⁵ See U.S., War Industries Board, American Industry in the War (Washington: Government Printing Office, 1921), pp. 12-48.

¹⁶ The divisions operated by the Office of the Chief Signal Officer in World War I included: Air, Aviation, Construction, Engineering and Research, Equipment, Executive, Finance and Supply, Land, Military Aeronautics, Photographic, Procurement, Purchases, Radio,

all of which were responsible to the Chief Signal Officer, General George O. Squier. This officer found himself in the unenviable position of supervising two major programs: signals and aviation, of which the air arm was by far the larger. As one member of General Squier's staff later recalled, "Until the spring of 1918 our situation, despite constant minor changes, was more a state of affairs than a chain of events."¹⁷

When the United States entered World War I the Aeronautical Division, which had replaced the Aviation Section on November 4, 1915, was one of three subdivisions of the Office of the Chief Signal Officer. On May 21, 1917, the Construction Division was created and charged with the preparation and maintenance of flying fields as one of its duties. Three days later, the Aircraft Engineering Division was also established and on August 2 the Equipment Division, each of which assumed control over certain aviation interests. In August, a Wood Section was established in the Office of the Chief Signal Officer to place contracts for airplane lumber, the demand for which had exceeded all expectations.¹⁸

On October 1, 1917, the Aeronautical Division was redesignated the Air Division, with functions limited to the conduct of aviation

Science and Research, Special Service, Spruce Production, Supply, and Supply and Accounts. Handbook of Federal World War Agencies and Their Records, 1917-1921 (Washington: National Archives, 1943), p. 521.

¹⁷ Henry H. Arnold, Global Mission (New York: Harper and Bros., 1949), p. 72.

¹⁸ Report of the Chief Signal Officer in War Department, Annual Reports, 1917, I, 838-841.

operations, to the maintenance of general supervision over military aircraft, and to the training of officers and men in matters relating to military aviation.¹⁹

On October 22, 1917, the Aircraft Engineering Division was replaced by the Science and Research Division.²⁰ On November 15, the Spruce Production Division was formally established (superseding the Wood Section) to increase the output of timber needed in airplane construction. By the latter months of 1917, aviation matters were the direct concern of five divisions: Air, Construction, Equipment, Science and Research, and Spruce Production.²¹

On January 14, 1918, the Construction Division was reorganized as the Supply Division, and it was charged with securing and distributing clothing, equipment, and all ordnance necessary for aviation troops in the United States; with the distribution of all spare planes, spare engines and their parts; with motor transportation; and with all other matériel and supplies necessary in the maintenance of flying fields, flying schools, and concentration camps within the United States. On March 20, 1918, a Conservation Section was created to conserve and reclaim all material of every nature purchased with Signal Corps funds.

In the spring of 1918 it was recognized that the existing system of organization was not functioning efficiently, and that a

¹⁹ Ibid., pp. 839-840.

²⁰ Handbook of Federal Agencies and Their Records, 1917-1921, p. 508.

²¹ Report of the Chief Signal Officer in War Department, Annual Reports, 1919, I, 893.

separate air service would solve the problem. On April 24, 1918, a first step, which rearranged the duties in the Office of the Chief Signal Officer, was taken by the War Department. This action reserved to the Chief Signal Officer the administration of signals and created a Division of Military Aeronautics as well as a Division of Aircraft Production. The exact division of functions in the matter of designing and engineering was to be worked out between the two agencies.

On May 27, 1918, President Woodrow Wilson formally transferred aviation from the Signal Corps to two independent agencies under the Secretary of War: the Bureau of Aircraft Production and the Division (Department) of Military Aeronautics. The latter, under Major General William L. Kenly, who had just returned from France, was responsible for training and operations. The new Bureau of Aircraft Production, formed from the old Equipment Division of the Signal Corps, was assigned "full and exclusive jurisdiction and control over production of aeroplanes, engines, and aircraft equipment" for the Army. Since its head, John D. Ryan, former president of the Anaconda Copper Company, was also chairman of the civilian Aircraft Board, a close and helpful connection existed between the two agencies. Although the War Department had officially recognized the Division of Military Aeronautics and the Bureau of Aircraft Production as constituting the Air Service, it did not choose to appoint a Chief of Air Service to coordinate the activities of the two agencies.²²

²² A special announcement was made that a Chief of Air Service would not be detailed so long as the Bureau of Aircraft Production was operating as a separate organization; and that the duties assigned to the Chief of Air Service by Army Regulations 1913 not specifically

The anomaly of creating the Air Service as an organization designed to coordinate the Division of Military Aeronautics' activities with the efforts of the Bureau of Aircraft Production and failing to designate a responsible head for the agency continued throughout most of the summer of 1918. On August 28, 1918, the President appointed John D. Ryan as Director of the Air Service and Second Assistant Secretary of War. As Director of the Air Service, Ryan was responsible for procuring and furnishing to the American Expeditionary Forces all matériel and personnel required by the Air Service. To accomplish this mission, he was given supervision, control, and direction over both the Division of Military Aeronautics and the Bureau of Aircraft Production, with authority to coordinate their activities and to develop their programs.²³ The position of Second Assistant Secretary of War was designed to give Ryan enough prestige to make his voice heard in the higher echelons of government.²⁴ While the appointment was a step towards the representation of aeronautics at a higher level, it may also have been designed to forestall the creation of a separate department of aeronautics for which there was a good deal of sentiment in Congress and among the American public.²⁵ The United States Air

delegated to the Director of Airplane Production by executive order would be performed by the Director of Military Aeronautics. A copy of the War Department announcement is found in War Department, Annual Reports, 1918, I, 1382-1383.

²³ General Order Number 81, War Department, August 28, 1918.

²⁴ As Second Assistant Secretary of War, Ryan replaced Edward R. Stettinius, who was then a special representative of the War Department in France. See editorial, "Second Assistant Secretary of War, John D. Ryan, Given Full Charge Over All Aircraft Work," Flying, VII (September, 1918), 720.

²⁵ One widely read service periodical credited the appointment

Service as a constituted part of the American military establishment emerged late in World War I, when many of the worst difficulties had already been, or were about to be, overcome.

For some weeks after the declaration of war little was accomplished towards increasing the strength of the air arm. The Chief Signal Officer, General George Squier, called in a number of civilian experts, scientists, engineers, and businessmen to assist him in meeting the problems of expansion which were certain to come. At the same time, the Allied nations were asked to send to the United States officers, pilots, and aeronautical engineers who were familiar with conditions at the front.

There were only a few officers on duty in the Office of the Chief Signal Officer who had had practical experience in aviation. While civilian experts were most capable in their own lines, they were ignorant of air problems. Because of this lack of knowledge of the practical problems to be encountered, the plans and programs drawn up by committees of experts were based on previous knowledge of production obtained in established industries, and this did not necessarily apply to the production of aircraft.

In May, 1917, the enlargement of the Signal Corps to full strength under the National Defense Act of 1916 was authorized, and on May 12 a congressional appropriation of \$10,800,000 was made to the Corps. On June 15 another appropriation of \$43,450,000 was voted; and an even larger amount of money was set aside for aviation in the next

to President Wilson's desire to forestall a movement for the creation of a Department of Aeronautics, declaring that Wilson was opposed to creating any additional cabinet offices at that time. Army and Navy Journal, August 31, 1918, p. 2021.

month.²⁶

Meanwhile, the Signal Corps was taking the preliminary step for the enlistment and training of men for the air service, but it was acting with no fully authorized plan on which to base the number of squadrons or airplanes. An important step in this direction was made by the Joint Army Navy Technical Aircraft Board on May 23, 1917, when it presented a report dealing with the training of troops for aviation. This report specified not only the number but the types of airplanes and engines required for the use of the American Army for training purposes. In addition, it estimated the number required in the event the United States should be called upon to train foreign air troops as well. It recommended that the Aircraft Production Board of the Council of National Defense make a survey of the industrial situation to determine not only the country's ability to meet the demands about to be made upon it, but also to foster airplane industries and to strengthen them to meet the nation's future needs. Furthermore, there was also a plan for obtaining from the Allies certain types of planes and engines to serve as models for the manufacturers. The Joint Army Navy Technical Board estimated that 7,050 planes and 15,100 engines would be required for the training of American personnel alone; if foreign fliers also were to be trained the overall requirement would be 9,900 planes and 19,800 engines. This program did not cover service (i.e. combat) planes for use in the war area. The program was approved by the Secretary of War and the Secretary of the Navy and thereupon became the

²⁶Edgar S. Gorrell, "America's First World War Appropriation," U.S. Air Services, XVIII (May, 1933), 24-27.

basic program for the production of training planes.²⁷

The Bolling Mission

In June, 1917, a special commission headed by Major Raynal C. Bolling was sent to Europe to keep the authorities in Washington informed of the changing conditions in the manufacture and equipment of airplanes and engines and of their performance in active service and to make recommendations as to the planes and engines to be reproduced in the United States. The commission included Captains Edgar S. Gorrell and Virginius E. Clarke of the Army; Commander G. C. Westerfelt and Lieutenant Warren G. Child of the Navy; Herbert Hughes and Howard Marmon, civilian industrial experts; and 93 skilled mechanics and factory experts.²⁸

Major Bolling reported to General Pershing in Paris on July 3, 1917. He held written instructions from the Secretary of War to represent the United States in negotiations with Allied governments on the questions of royalties, the general assistance desired from the United States, and types of equipment for production, and other similar problems. This commission selected the types of airplanes to be produced in the United States and made arrangements for the United

²⁷ Benedict Crowell, America's Munitions, 1917-1918 (Washington: Government Printing Office, 1919), p. 239; War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, pp. 41-42.

²⁸ Mason M. Patrick, The United States in the Air (Garden City, N.Y.: Doubleday, Doran and Co., 1928), p. 10.

States to obtain material abroad, which could be used until America was able to get into production.²⁹

By the end of July, 1917, about a month and a half after sailing for Europe, the Bolling Commission had visited all the Allies and secured information upon which to base a report. At a conference attended by representatives of the French, British, and Italian governments, as well as the aviation officers of General Pershing's staff, the members of the mission prepared a cable to Washington describing in detail the specific types of aircraft they had chosen for production in the United States. Actual samples of each aircraft selected were shipped to the United States to assist in production. Five months passed, however, from the time America entered the war before the initial selection of designs was made and detailed planning for production began.

The formal report of the Bolling Commission represented a middle-of-the-road course between the extreme views of proponents of strategic bombardment and the advocates of tactical aviation. It laid down a pattern for production: first, training aircraft; second, aircraft for use in cooperation with the ground forces; third, fighters and bombers.³⁰ The report established a time schedule for production. In the United States, the third place position of the strategic force

²⁹Mason M. Patrick, Final Report of the Chief of Air Service, AEF, to the Commander-in-Chief, American Expeditionary Forces (Washington: Government Printing Office, 1921), p. 24. Hereafter cited as Patrick, Final Report.

³⁰Raynal C. Bolling, "Report of Special Commission," August, 1917, in USAF HD Archives.

was taken to mean that it was third in order of relative importance. The members of the Bolling Commission were most likely unaware that the order of priorities inferred from their report would have such a great influence upon the evolution of American aerial doctrine. The opinion of Bolling expressed in other correspondence showed that he had a stronger appreciation of the strategic role of air power than this report would suggest.³¹

One recent student of the history of American military aviation writes that the members of the Bolling Commission were responsible not only for their technical decision but for their decision on aerial doctrine as well, even if the latter were implicit, incidental, or unintentional.

The Bolling Mission had a remarkable opportunity to shape the content of and give direction to the doctrine of air power in the United States. To say that the mission failed to make the most of this opportunity is to cast no discredit upon the individuals in the group. Their assigned objective was to determine the best possible types of aircraft for production in the United States. The mission accomplished this objective. At a meeting of 31 July 1917, it selected four major types of allied aircraft for use by the American Expeditionary Forces. The British DH-4 was selected as the best plane for observation and day bombardment available for quantity production, the British Bristol and the French Spad were chosen for fighters, and the Italian Caproni and British Handley Page were designated as the long-range bombers.³²

³¹As early as June 29, 1917, Bolling had reported on the views of Gen. Sir David Henderson of the British Air Board. Gen. Henderson believed that observation aircraft should be provided on a troops basis; fighters should be provided in quantities great enough to drive the enemy from the air (probably a three to one superiority would be required); and bombers should be procured in a quantity limited only by the nation's ability to produce. Later Bolling wrote that he thought that both the French and British had overemphasized fighters at the expense of bombers and that the Italian bombing operations gave proof of the profitable results to be derived from a strategic bomber force. Holley, Ideas and Weapons, p. 55.

³²Ibid., pp. 59-60.

Some of the mechanics who had accompanied the Bolling Commission were sent back to the United States from time to time, taking to the Aircraft Production Board the lessons they had learned as well as samples of aeronautical material. By October 24, 1917, only about 32 of the original 93 civilian mechanics remained in Europe. Most of these experts were later commissioned in the American Air Service.³³

Foreign Missions

The entry of the United States into the war was, of course, greeted with much enthusiasm by its European Allies. Great Britain, France, and Italy had closely guarded the technical information about the development and use of their airplanes since 1914. After America's entry into the conflict, however, they began to give all the advice and detailed data in their power. In response to a request from the Chief Signal Officer, these nations sent commissions to advise the Americans on the whole subject of military aeronautics. The assistance which they rendered was invaluable. Naturally there was a lack of unanimity of opinion among the professional aviators of the different countries on many points concerning the relative merits of foreign planes, and much divergent counsel was received, but much was learned from them.³⁴

³³"History of Civilian Motor Mechanics Group in Airplane Construction Service of United States Signal Corps," 1917; History of the Air Service, American Expeditionary Forces, Series A, Vol. 2, pp. 20-80, in the National Archives. This work cited hereafter as Hy AS AEF with the series designation preceding.

³⁴Report of the Chief Signal Officer in War Department, Annual Report, 1918, I, 1074.

The French were of the opinion that American support could take the most effective shape by reinforcing immediately the Anglo-French air forces on the western front. The French believed the need for this to be most urgent and pointed out that America's vast resources in material and her mechanical industries peculiarly fitted the United States for this undertaking. This opinion found official expression on May 23, 1917, in a cablegram from the French Prime Minister Alexandre F. Ribot.

It is desired that in order to co-operate with the French Aeronautics, the American Government should adopt the following program: The formation of a flying corps of 4,500 airplanes-- personnel and matériel included--to be sent to the French front during the campaign of 1918. The total number of pilots, including reserve, should be of 5,000 and 50,000 mechanics.

2,000 airplanes should be constructed each month, as well as 4,000 engines, by the American factories. That is to say, that during the first six months of 1918, 16,500 planes (of the last type) and 30,000 engines will have to be built.

The French Government is anxious to know if the American Government accepts this proposition, which would allow the Allies to win supremacy of the air.³⁵

These few sentences laid the foundation for American aviation in World War I.

The program suggested by the French was far greater than anything heretofore contemplated, and this request was referred to

³⁵ Translation of cablegram, Premier Ribot of France to the French Ambassador in Washington, J. J. Jusserand, dated May 23, 1917, as printed in Pershing, My Experiences in the World War, I, 28. In July, 1917, William G. Sharp, the American Ambassador to France, cabled the Secretary of State in Washington to report that the Ribot message as originally drafted in France also mentioned that the 4,500 aircraft should consist of "half bombers and half fighters" and that the "other necessary types" (presumably observation aircraft) should be reckoned in addition to this total. Whether this significant portion of the message was omitted on purpose or by accident and whether the deletion took place in France or in the United States is not known. For some interesting observations on the alterations of the Ribot telegram which were not discovered until after the war, see Holley, Ideas and Weapons, p. 44.

the Joint Army and Navy Technical Aircraft Board. The report of this board, prepared by Major Benjamin D. Foulois and presented on May 29, 1917, stated that in order to comply with the wishes of the French, the United States Army would require in Europe 9,000 airplanes for the fighting line and 3,000 in reserve, making a total of 12,000 service planes and 24,000 engines. The report further stipulated that 3,000 of the aircraft were to be reconnaissance or observation, 5,000 were to be fighters, and 1,000 were to be bombers, with a reserve of 1,000, 1,667, and 33 in the last three categories respectively. This equipment was to be produced before June 30, 1918. Combined with the 9,900 training planes (which included the estimate for training foreign fliers) the two reports comprised a program for building a total of almost 22,000 planes. The number of engines required for these planes was estimated at 43,800.³⁶

Plans, Programs, and Projects

On June 13, 1917, the Chief of the War College Division of the General Staff requested a statement from the Council of National Defense as to the practicability of effecting the production as estimated by the Signal Corps, without undue interference with or disorganization of the industries of the United States.³⁷ A prompt answer was received in which the American industrial situation was analyzed at length. What

³⁶ War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, pp. 42-43.

³⁷ Memo from Chief of War College to the Council of National Defense, June 13, 1917, A, Hy AS AEF, Vol. 1, p. 27.

had already been accomplished by the Signal Corps as a tentative beginning was recited, and the manufacturing resources that could be relied on were specified in detail. The report stated that the program submitted to the Aircraft Production Board was a gigantic one, but capable of being accomplished as outlined, provided funds were quickly appropriated and no delays permitted.³⁸

The War College Division was not entirely satisfied that the plan could be fully realized within the specified time, but assumed that the specialists of the Council of National Defense and the Aircraft Production Board, who were also consulted, were best qualified to judge the manufacturing capacity of the country. It was decided that the importance of pre-eminence in aviation was so great that the United States should not be deterred by the magnitude of the problems presented, and that even though the plans might not be realized in their entirety, they would constitute a project which would inevitably contribute to the establishment and maintenance of aerial supremacy. The War College Division therefore recommended the adoption of the proposed aviation plan.³⁹

Officials of the General Staff feared that the enormous amount of material required for such a program would affect all other production in the United States. (There was some reason for their concern, as the subsequent industrial mobilization was to demonstrate.)

³⁸Letter from the Council of National Defense to the Chief of War College, June 17, 1917, A, Hy AS AEF, Vol. 1, pp. 33-34.

³⁹War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, p. 43.

In any event, mulling over the problem took time, and any long delay in reaching a decision threatened to wreck the program. General George O. Squier, who was in charge of the Signal Corps and responsible for the Aeronautical Division, took the problem over the heads of the General Staff, directly to the Secretary of War, Newton D. Baker. Secretary Baker formally approved the program and issued a statement on June 18, 1917, announcing that "the War Department is behind the aircraft plans with every ounce of energy and enthusiasm at its command."⁴⁰

In the light of America's unpreparedness the magnitude of this program was most impressive. Not only must 22,000 airplanes be constructed within a year but for each airplane there must be provided approximately 80 per cent additional spare parts.⁴¹ Thus the 22,000 airplanes really became 39,600 without counting replacements or the 725 airplanes needed for home and insular services. Each of the 22,000 airplanes must have approximately two engines. In addition it was necessary to provide the flying personnel to operate the planes. It was necessary for thousands of additional officers and enlisted men, executives, instructors, and skilled mechanics to be available to support and train the 5,000 pilots and to care for their airplanes.⁴²

⁴⁰ Sweetser, The American Air Service, pp. 69-79.

⁴¹ The need for spare parts was not fully realized. One Air Service officer, speaking with the Director of the Bureau of Aircraft Production Howard E. Coffin about the flood of aircraft to be constructed in the next few months, asked, "How many spare parts have you ordered, Mr. Coffin?" "Spare parts?" he asked, apparently startled. "What do you need spare parts for?" "Arnold, Global Mission, pp. 67-68.

⁴² War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, p. 44.

Just how difficult a task France had given the United States can be seen when it is realized that France herself had not produced in the period of almost three years preceding America's entry into the war as many planes as she was asking the United States to build in one year. In view of the fact that America's aviation industry was still in its infancy and the dearth of American aeronautical engineers, it was small wonder that the Air Service was never able to catch up with its schedules.

Evidently the American press was unaware (or ill-advised) of the problems involved, for immediately following the approval of the aviation program suggested by the French, the public was informed through an intensive newspaper campaign that the United States's contribution to the defeat of Germany was to be mastery of the air. Unfortunately, many misleading statements appeared in newspapers and magazines.

The New York Herald of June 18, 1917, carried the headline, "Greatest of Aerial Fleets to Crush the Teutons," and in a subheadline, "\$600,000,000 for Flying Fleet to Drive Prussians from Air Backed by War Department." It announced that the United States was to become an aviation training base for all the Allies.⁴³ Two days later the New York Times stated that:

The United States Government is making plans to turn out engines for battle planes at the rate of 2,000 a month, and will be prepared to deliver the first consignment by November, according to information obtained today from representatives of the Aircraft Production Board.

The article went on to say that:

⁴³ New York Herald, June 18, 1917, p. 1.

. . . training planes will be turned out in great numbers to supply the camps in Europe and the United States. . . . Within a comparatively short time, if Congress grants the proposed appropriation of \$600,000,000, it is hoped to relieve the British and French factories from all work except the making of highly specialized fast fliers. . . . Factories in this country, eventually, will also turn out that type of machine.⁴⁴

Congress appropriated \$640,000,000 for aviation late in July, 1917. This bill was the largest appropriation ever authorized by the United States Congress up to that time for a single specific purpose. The legislation was enacted by both houses of Congress in about two weeks and was signed by President Wilson on July 24, 1917.⁴⁵

Despite the fanciful enthusiasm of some of the American military leaders (including the Secretary of War),⁴⁶ and the generous allocations of funds by Congress, aircraft production in the United States moved ahead slothfully. By February, 1918, the disturbingly unimpressive total of but nine observation aircraft (modified versions of the British De Havilland DH 4) had been produced. During the following month only four more came off the assembly line. A full year after the declaration of war only 15 aircraft had been produced and none of these were of the fighter or bomber type.⁴⁷

⁴⁴New York Times, June 20, 1917, p. 1.

⁴⁵Mooney and Layman, "Organization of Military Aeronautics, 1907-1935," USAF Historical Study No. 25, 1944, p. 28; Crowell, America's Munitions, 1917-1918, p. 240.

⁴⁶One widely circulated magazine featured an illustrated story describing the facility with which aircraft could be mass produced. See Waldemar B. Kaempffert, "The Eagle Spreads His Wings: How 23,625 American Airplanes Will Be Built at the Rate of 3,500 a Month to Crowd the Germans Out of the Air," Popular Science Monthly, IX (December, 1917), 894-898.

⁴⁷Mixter and Emmons, United States Army Aircraft Production Facts, p. 48.

In the spring of 1918, as news of the failure of American aircraft production became known, a storm of controversy erupted.

Our airplane production, heralded as record-breaking and soon to give Americans control of the air at the front, has been a mirage of iridescent ants. The reality has undeceived even those who were least credulous.⁴⁸

In the heat of criticism a number of investigations, official and unofficial, were undertaken to quell the rising tide of irate public indignation.

In August, 1918, a Senate committee (assisted by its special investigator Charles Evans Hughes) which had been appointed to investigate aircraft production made its report. Though it found no evidence of fraud, the committee charged that there had been waste and unnecessary delay in aircraft production and placed considerable blame on the policy of adapting all tactical aircraft to the Liberty engine rather than manufacturing exact copies of the European models.⁴⁹

Late in October the report of the Hughes Committee was made public. It attributed delays and waste in aircraft production to inadequate organization and to lack of competent direction by officers of the Signal Corps. The Committee recommended that Colonel Edward A. Deeds be tried by court-martial and that several other officers be prosecuted because of transactions on behalf of the government with corporations. Colonel Deeds was never tried, largely because of his valuable work in aviation, nor were the other officers prosecuted.⁵⁰

⁴⁸ See editorial in the New York Times, March 20, 1918, p. 12.

⁴⁹ Mooney and Layman, "Organization of Military Aeronautics, 1905-1935," USAF Historical Study No. 25, 1944, p. 33.

⁵⁰ "Col. Deeds Not to be Court-Martialed," Air Age Weekly, November 7, 1918, p. 1.

The Hughes Committee called attention to the administrative and organizational deficiencies of the air arm as had the reports of other investigating groups. The Hughes report was received with a feeling of relief by the public, which had been led to believe that grave charges of fraud and corruption would result from the inquiry.⁵¹

Included in the first increment of 1,800 men authorized by the War Department were five aviation school squadrons.⁵² The 1st Aviation School Squadron was located near San Diego, California, the 2d near Mineola, New York, the 3d near Memphis, Tennessee, the 4th near Chicago, Illinois, and the 5th near Hampton, Virginia.⁵³ These squadrons were organized in addition to the first seven aero squadrons which had already been formed or were in the process of being formed at the beginning of the war.

On May 1, 1917, the Chief Signal Officer recommended that the following additional organizations be authorized: six aero squadrons (the 8th through the 13th) to be formed at San Antonio, Texas, each to be comprised of 150 men; the 1st and 2d Balloon Squadrons to be formed at Fort Omaha, Nebraska, each to be composed of 150 men; the 6th Aviation School Squadron of 150 men to be organized at San Diego, California; the 1st Balloon School Squadron of 150 men, to be organized at Fort Omaha; and a temporary aviation station composed of 20 men to

⁵¹The report of the Hughes Committee was published in Air Age Weekly, November 7, 1918, p. 1.

⁵²An aviation school squadron was an organized unit of the Signal Corps Aeronautical Division employed in training or experimentation.

⁵³War Department, Order of Battle, III, Part 2, 1101-1102.

be located at Essington, Pennsylvania. This made a total of 1,520 men in the second increment.⁵⁴ On May 5, 1917, however, the Adjutant General wrote that the plan of organizing the remaining increments would not be put into effect until Congress had acted on the legislation proposed by the War Department for raising additional forces.⁵⁵

The only one of the first seven aero squadrons organized which reached France was the 1st Aero Squadron. This organization, which was the first American aero squadron in France, sailed from New York on August 9, 1917, under the command of Major Ralph Royce, and became an observation squadron in the American Expeditionary Forces. It was almost constantly in active service at the front from April through November, 1918.⁵⁶

⁵⁴"Regular Army Increase," Correspondence, 1917, Office of the Chief Signal Officer, Box 584, File No. 320.2 in the National Archives.

⁵⁵Ibid.

⁵⁶"History of the 1st Aero Squadron," 1918, E, Hy AS AEF, Vol. 1, pp. 1-107. The problems involved in transporting the 1st Aero Squadron to France were symptomatic of the delay and confusion which pervaded so much of the military establishment during the early months of the war. The Squadron was ordered to accompany the 1st Infantry Division overseas. "By the end of May, the Squadron was all packed up, ready for transportation from the Mexican Border to the Port of Embarkation. The 1st Division sailed in June, and in so far as the theoretically secret details of that troop movement were known by the General Staff, the 1st Aero Squadron was with it. But according to plaintive messages received from the 1st Aero Squadron itself, it was with nobody--it was still left behind, with all its goods and chattels packed and crated and on the railroad sidings and platforms--at Nogales, Arizona. It had nothing to do and was getting bored. The Commanding Officer sent in one telegram after another about its plight, but it required several to convince those of our General Staff in charge of the movement of the 1st Division that the 1st Aero Squadron was not in France." Arnold, Global Mission, p. 59.

CHAPTER V

ORGANIZATION OF THE AIR SERVICE, AMERICAN EXPEDITIONARY FORCES

Early Organization in France

On May 26, 1917, while still in Washington, Major General John J. Pershing assumed his duties as Commander-in-Chief of the American Expeditionary Forces.¹ On the following day, General Pershing received instructions defining his authority and mission from the War Department. The establishment of the American Expeditionary Forces Air Service as an organization separate from the Signal Corps in the overseas theater began with the appointment of the first "aviation officers" to General Pershing's staff. Major Townsend F. Dodd, who had been Department Aviation Officer at San Antonio, Texas, was assigned to Pershing's staff on May 26, 1917, while in Washington, D.C.² Major Dodd appointed First Lieutenant Birdseye B. Lewis, who had been serving with him on the Mexican border, as his assistant.³

¹General Order Number 1, Headquarters, American Expeditionary Forces, Washington, D.C., dated May 26, 1917. U.S., Department of the Army, Historical Division, United States Army in the World War, 1917-1919 (Washington: Government Printing Office, 1948), XVI, 1. Gen. Pershing's orders appear in a number of documents collections; this particular compilation was used for this dissertation. All footnotes citing general orders from AEF headquarters have been drawn from Volume 16 of this set.

²Ibid.

³"Organization of the Air Service, American Expeditionary Forces, 1917," A, Hy AS AEF, Vol. 1, p. 1.

Lewis went to New York to engage clerks, interpreters, and chauffeurs.⁴

On May 29, 1917, Pershing and his staff sailed for Europe on the Baltic, arriving in England on June 8. After a brief stay in London, Pershing moved his headquarters to Paris, where by the middle of June, 1917, he had established liaison with the Grand Quartier Général under General Henri-Philippe Pétain. Meanwhile, Major Dodd conferred with British air officials and the Chief Signal Officer of the American Expeditionary Forces, Colonel Edgar Russell, and visited a number of British air centers. Dodd arrived in Paris on June 20 and established aviation headquarters at 49 Boulevard Haussman. Dodd's incumbency in this office was short-lived, for on June 30 Lieutenant Colonel William Mitchell, who had been in France since April, 1917, and was the ranking air officer in Europe, was appointed Aviation Officer on Pershing's staff.⁵ Also in Mitchell's office were four other air officers, all captains, who had arrived sometime earlier: Joseph E. Carberry, Millard F. Harmon, Davenport Johnson, and Carleton G. Chapman, the last having been an observer in England since 1916. In addition to these American officers, a small civilian office force and an attached French mission composed of two officers and an adjutant were members of Mitchell's staff.⁶

⁴ Among others, Lewis selected Sgt. Edward V. Rickenbacker, a well-known automobile racing driver, as chauffeur.

⁵ General Order Number 4, Headquarters, American Expeditionary Forces, Paris, France, June 30, 1917.

⁶ Memo for Col. Edgar S. Gorrell, "Early Aviation in France," from Capt. R. G. Kincaid, December 28, 1918, A, Hy AS AEF, Vol. 2, p. 101.

Mitchell had been working on aviation matters before Pershing and his staff arrived in France. On April 20, 1917, he had cabled to Washington plans for the creation of an American air force in Europe. This proposal called for two distinct forces: one consisted of squadrons attached to the ground armies, corps, and divisions under the control of ground commanders; the other was composed of large aeronautical groups for strategic operations against the enemy aircraft and matériel at a distance from the actual line. The bombardment and pursuit units making up this force would have an independent mission and would be used to take the war into enemy territory. This was the beginning of the American version of the concept of strategic bombardment. Mitchell's ideas reflected the influence of the foremost prophet of air power of his time, Major General Sir Hugh M. Trenchard, Commander of the British Royal Flying Corps and advocate of strategic bombing and unified air command.⁷

When Mitchell's plan met with no response, Mitchell decided to work through the French Government. Accordingly, he arranged a conference at French Grand Quartier Général, and on May 6, 1917, as a result of this meeting, the commander of the French armies sent to the Minister of War an outline of the size of the air force which the United States should be requested to furnish. The memorandum called for 5,000 planes on the line by May 1, 1918, and 15,000 to be delivered later, a heavy monthly output of engines, and 38,500 airplane mechanics. From this outline grew the Ribot cablegram of May 23, 1917,

⁷Goldberg, A History of the United States Air Force, 1907-1957, p. 21.

for which Mitchell was at least partly responsible.⁸

Shortly after Pershing and his staff arrived in Europe, Mitchell presented a study proposing the organization of an aerial arm to the Chief of Staff of the American Expeditionary Forces.⁹ Mitchell's plan thrust the problem of the proper organization of aviation to the front, and six days after receiving it, General Pershing appointed a board of officers to determine the form and composition of the American Expeditionary Forces' aerial arm. The Aviation Projects Board was composed of the following officers: Colonel Edgar Russell; Colonel William Mitchell; Majors Marborough Church, Townsend F. Dodd, and Frank Parker; and Captain Joseph E. Carberry.¹⁰ The prevailing French military doctrine regarding the role of the air weapon as well as the views of Mitchell helped the six officers in forming a final report. The board decided to plan from the assumption that a decision in the air had to be sought and obtained before a decision on the ground could be reached. To this end it recommended that the composition of the air service follow a program suggested by the French. The French plan recommended a force of 30 bomber groups and 30 fighter groups for the strategic element of the air arm; and for the observation operations, a service of a size determined entirely on a troop basis to take care of the ground arms.

⁸ Isaac D. Levine, Mitchell, Pioneer of Air Power (New York: Duell, Sloan and Pearce, 1943), p. 98.

⁹ Memo for the Chief of Staff from William Mitchell, dated June 13, 1917, A. Hy AS AEF, Vol. 1, p. 17.

¹⁰ Special Order Number 11, Headquarters, American Expeditionary Forces, Paris, June 19, 1917, A. Hy AS AEF, Vol. 12, p. 36.

The board prepared copies of its recommendations for Pershing's signature in the form of cables to the War Department. Apparently the cables never left France. The composition of the Air Service, American Expeditionary Forces, remained unsettled until July, 1917, when the General Organization Project was drafted.¹¹

The General Organization Project, a comprehensive plan for the American Expeditionary Forces as a whole, was drafted by General Pershing's Operations Section and approved by him on July 11, 1917. This project provided for 59 Air Service squadrons to operate with five army corps. The Air Service was to be made up of 39 squadrons for observation, 5 for bombing, and 15 for pursuit. Strategic aviation was allotted a low priority in the initial program of the American Expeditionary Forces. The General Organization Project was intended only as a preliminary draft outlining the desired tactical organization of the overseas forces.¹²

In the meantime the first air squadron program was prepared in Washington by the Office of the Chief Signal Officer and was approved by the Chief of Staff on August 9, 1917. In this project there were authorized 345 service squadrons, 45 construction companies, 81 supply squadrons, 11 repair squadrons, and 26 balloon companies. Of these, 74

¹¹The cables are reproduced along with Mitchell's account of his role in the early planning of the American Expeditionary Forces in Europe in William Mitchell, Memoirs of World War I (New York: Random House, 1960), pp. 135-137.

¹²"General Organization Project," Headquarters, AEF, Paris, July 10, 1917, G-3, Folder 748A in the National Archives as printed in Department of the Army, United States Army in the World War, 1917-1919, I, 93; 100-101; 104.

service squadrons were for duty in the United States and 8 for Panama and the islands of the Pacific, leaving 263 for duty in France.¹³

In order to conform to the War Department plan, the American Expeditionary Forces began work on a detailed squadron project. This program, contemplating an overseas army of 20 combat and 10 replacement divisions together with the necessary corps, army, and service of supply troops, provided for 386 aero service squadrons, 264 park squadrons, and 69 observation balloon squadrons. Of the aero service squadrons, 260 were for the Service of the Front as differentiated from the Service of the Rear, which included only those for training and replacement.¹⁴

In addition to a strategic force of 59 aero squadrons, a tactical force of 201 squadrons was envisioned: 41 for observation, 55 for bombardment, and 105 for pursuit. This plan, after a few changes, became the first official aviation program in the American Expeditionary Forces. Program Number One, as it was later called, represented a total of 260 squadrons: 120 pursuit, 80 observation, and 60 bombardment. This program was incorporated in the Service of the Rear Project approved by General Pershing on September 18, 1917.¹⁵

The formation of an organization capable of carrying on all

¹³"Air Service Program" August 9, 1917, A, Hy AS AEF, Vol. 1, pp. 78-85.

¹⁴Patrick, Final Report, p. 23. See also the plans for the Air Service in the Zone of Advance in Report, Commander-in-Chief, AEF Folder 1, dated February 12, 1919, in Department of the Army, United States Army in the World War, 1917-1919, I, 134-137.

¹⁵Patrick, Final Report, p. 10.

the necessary American aviation projects in Europe seemed a hopeless task in the beginning. Few Americans trained in aviation activities were already overseas, and the necessity of retaining in the United States the small handful of experienced men limited the possibilities of assistance from that source. There was a deficiency of clerical assistants, supply officers, and men with technical training. Practically all technical communications and most current correspondence were in a foreign language, requiring interpreters and stenographers capable of taking dictation in and writing in both French and English. France, England, Italy, and the American Expeditionary Forces were combed for the needed people.¹⁶

By the beginning of August, 1917, the aviation organization for the American Expeditionary Forces was clearly defined. Major Raynal C. Bolling, with his knowledge of production, was put in charge of the Zone of Interior and Colonel William Mitchell, still with his title of Aviation Officer, American Expeditionary Forces, was given jurisdiction and control over the Zone of Advance. The Zone of Advance was concerned with the choice of airdrome sites and the initiation of construction in preparation for future activities at the front. The Zone of Interior was concerned with the development of the supporting organizations, such as supply, training, and technical matters. This organization, with one officer in charge at the front and another officer in charge at the rear, resulted in divided responsibilities, and these two divisions were brought under one head on

¹⁶Ibid., p. 26.

August 28, 1917, by the appointment of Colonel William L. Kenly as Chief Aviation Officer, American Expeditionary Forces.¹⁷ On September 3, 1917, Kenly, who had been promoted to Brigadier General, was made Chief of the Air Service, American Expeditionary Forces.¹⁸ Colonel Bolling was appointed Assistant Chief of the Air Service and Director of Air Service Supplies, with headquarters in Paris. Colonel Mitchell became Air Commander, Zone of Advance, and early in September his office and that of the Chief of Air Service were moved to Chaumont, where Pershing had established his headquarters.

In Paris, Lieutenant Colonel Joseph E. Carberry was made Chief of Training, and Lieutenant Colonel Edgar S. Gorrell was appointed Chief of the Technical Section; Lieutenant Colonel Carleton G. Chapman was designated the Chief Disbursing Officer. Major Robert Glendinning was appointed Chief of Personnel; Major R. L. B. Lyster, Chief of Construction; and Major Warwick Greene served as assistant to Colonel Bolling. In the Zone of Advance at Chaumont, Lieutenant Colonel Lawrence S. Churchill was the Assistant Chief of Air Service; Lieutenant Colonel Townsend Dodd was made Chief of Matériel with Major Birdseye B. Lewis and First Lieutenant R. G. Kincaid as his assistants; Major Millard F. Harmon was appointed Operations Officer.¹⁹

¹⁷ Col. Kenly was senior to Col. Mitchell; his rank had been granted before the latter's. "Organization of the Air Service, AEF," 1917, A, Hy AS AEF, Vol. 1, p. 7.

¹⁸ General Order Number 31, Headquarters, American Expeditionary Forces, September 3, 1917.

¹⁹ Memo for Col. Edgar S. Gorrell, "Early Aviation in France," from Capt. R. G. Kincaid, December 28, 1918, A, Hy AS AEF, Vol. 2, pp. 102-105.

By the end of September, 1917, the aviation organization of the American Expeditionary Forces had been changed to some extent. The name of the Zone of Interior branch had been changed to Lines of Communication. The departments of administration, production, finance, transportation, and the technical section were now under the control of the Assistant Chief of Staff, Lines of Communication. The Director of Air Service Instruction, under the Assistant Chief of Air Service, Lines of Communication, was in charge of personnel, matériel, instruction, and transportation assigned for his use. The Air Commander, Zone of Advance, maintained a staff composed of officers in charge of administration, operation, information, and matériel departments. He was charged with the organization and equipment of units formed in the Zone of Advance and with the actual preparation for their employment in combat. These branches of the Air Service communicated directly with each other, but all matters of policy were controlled by the Chief of Air Service, American Expeditionary Forces.²⁰

During the fall of 1917, there were no American air squadrons available for duty at the front except the 1st Aero Squadron, which had arrived in Europe in September and after a period of training at Avord had been located at Amanty near the I Corps School.²¹ Hence, the main problems of the Zone of Advance consisted of the study of tactics and

²⁰General Order Number 46, Headquarters, American Expeditionary Forces, France, October 10, 1917. Mitchell was designated the Air Commander, Zone of Advance.

²¹Col. La Roy S. Upton was named Commandant of 1st Army Corps Schools, with Maj. Ralph Royce of the 1st Aero Squadron as the Director of the Aeronautical Schools. General Order Number 35, Headquarters, American Expeditionary Forces, France, October 8, 1917.

strategy in the British and French air services, the selection of suitable sites for airdromes and supply depots, and the preparation for the deployment of combat units. The construction of the 1st Air Depot and airdrome at Colombey-les-Belles was begun in October, 1917. This installation was to be used as a receiving and distributing point for personnel, matériel, and supplies, and as a site for minor repairs to engines, airplanes, and motor transport.²²

Activity in the Lines of Communications consisted of making preparations for putting combat units in the front lines and providing for their training, equipment, and maintenance. Schools and training centers had to be provided for American Air Service personnel. By late November, 1917, flying training had begun in a school at Issoudun, near the French schools of Avord and Châteauroux.²³ The French Aviation School at Tours had been taken over for primary training and that at Clermont-Ferrand was about to be turned over to the United States for bombardment instruction. In addition, several detachments of cadets had been sent to other French schools and one detachment had gone to Italy for primary training.²⁴

²²"Organization of the Air Service, American Expeditionary Forces," 1917, A, Hy AS AEF, Vol. 1, p. 1.

²³General Order Number 60, Headquarters, American Expeditionary Forces, France, November 13, 1917. Lt. Col. Thomas Milling was the first commandant of the school.

²⁴Training in Europe is fully discussed in Chapter VII of this study.

Reorganization and Later Developments

On November 27, 1917, Brigadier General Benjamin D. Foulois became Chief of the Air Service, American Expeditionary Forces, relieving Brigadier General William L. Kenly.²⁵ Before going to France, General Foulois, who was well aware of the limitations of some of the young air service officers, had selected a staff of 112 officers to take to France with him. In view of the limited number of experienced executive officers among the trained fliers, most of these men were nonflying officers of administrative ability, chosen for their experience and skill in various fields. Some had been General Staff officers (few, if any, aviation officers had ever served on the General Staff up to this time); some had experience in military organization, administration, training, and discipline; some were experienced in the supply and maintenance of balloon and aviation equipment; while others, when civilians, had had experience in industry.²⁶

General Foulois and his party arrived in France on November 12, 1917. In the two weeks prior to his assignment as Chief of the Air Service, Foulois made a thorough inspection of all Air Service activities in France. As a result of this inspection, on December 1, 1917, he recommended to the Chief of Staff that a priority schedule of matériel be authorized, that certain areas be assigned as concentration depots for Air Service personnel and matériel, that the Supply Division remain

²⁵General Order Number 66, Headquarters, American Expeditionary Forces, France, November 27, 1917.

²⁶Benjamin D. Foulois, "Personal Service Record, 1898-1919," 1919, p. 10, in Foulois Collection, USAF HD Archives.

in Paris, and that the other divisions be located with the Air Service headquarters at Chaumont. He also recommended that a Joint Army and Navy Aircraft Committee be established in Paris and that construction for Air Service be placed under the Engineers.²⁷ Foulois further recommended that a comprehensive plan of air operations be authorized as soon as possible and that combat operations in cooperation with the French and British might be inaugurated at the earliest practicable date.²⁸

During his inspection trip, General Foulois also noticed that there was a lack of cooperation between Colonels Bolling and Mitchell, each of whom wanted control of supply. Foulois agreed with Bolling that supply should be under the jurisdiction of the Lines of Communication, but he felt that these two men, both of whom were strong willed, were not going to get along; therefore, on December 12, 1917, he put Colonel Robert O. Van Horn in charge of all Air Service projects in the Zone of Advance not actually under the control of combat troops, thus relieving Mitchell of any responsibility for location and construction of airdromes, training and supply of units until they were officially committed to combat. He also relieved Colonel Bolling from his position as Assistant to the Chief of Air Service in the Lines

²⁷ Col. Bolling and the Engineers had had difficulty in getting along and Foulois used this recommendation as a means of stopping further trouble. See enclosure A, "Lack of Co-operation between Col. Raynal C. Bolling . . . and Headquarters, Lines of Communications," in Benjamin D. Foulois, "The Air Service, American Expeditionary Forces, 1917-1918," 1924, p. 5, in Foulois Collection, USAF HD Archives.

²⁸ Memo to the Chief of Staff, AEF, from General Foulois, December 1, 1917, in Benjamin D. Foulois, "Personal Service Record, 1898-1919," 1919, pp. 11-12, in Foulois Collection, USAF HD Archives.

of Communication to take over the duties of Chairman of the Joint Army and Navy Aircraft Committee, which had been created on October 22, 1917, by the Aircraft Production Board in Washington. Authority for the formation of this committee in the American Expeditionary Forces was later given by Pershing's headquarters.²⁹ The Committee was composed of Colonel Bolling (chairman), Colonel Sidney D. Waldon, Lieutenant Colonel Edgar S. Gorrell, Captain A. C. Cable, and two Navy officers. It operated under the control of the Commander-in-Chief, American Expeditionary Forces, for Army matters and through the Commander, United States Naval Forces in European Waters, for Naval matters. The purpose of the Committee was to coordinate industrial and military activities in Europe and the United States and to constitute the proper official channel for communications with the European nations relative to aircraft matériel. During the early months of 1918, while the most strenuous development of the American Air Service was being undertaken, this committee assisted greatly in the allocation of aircraft products.³⁰

With the arrival of raw material from the United States, it became necessary to allocate and distribute it. It was evident that foreign aviation, based on a system of unregulated private manufacturers, was greatly lacking in standardization. This was particularly serious

²⁹ General Order Number 80, Headquarters, American Expeditionary Forces, France, December 24, 1917.

³⁰ Enclosure C, "Lack of Co-operation between Col. Raynal C. Bolling . . . (While serving as Chairman, Joint Army and Navy Aircraft Committee, in Paris) and Brig. Gen. B. D. Foulois (while serving as Chief of Air Service, AEF)," in Benjamin D. Foulois, "The Air Service, American Expeditionary Forces, 1917-1918," 1924, pp. 1-3, in Foulois Collection, USAF HD Archives.

in view of the shortages of spruce, linen, and other supplies. In order to bring about standardization the Interallied Aircraft Board was created and it did valuable work in bringing together the French, British, and Italian Air Services on this vital matter.³¹

Difficulties arose in the Joint Army and Navy Aircraft Committee when Army members were not allowed to deal directly with the Aircraft Production Board in Washington, while the Navy was given this power. Bolling felt that the Committee should be abolished since it would not be a "useful instrument for any purpose" under these conditions because communications were too slow, and the foreign nations could get the information they needed from their own missions in the United States more quickly than they could from the Joint Army and Navy Aircraft Committee. Because Bolling was so openly critical of this arrangement, General Foulois removed him from the chairmanship on January 19, 1918.³²

Although Foulois thought it necessary to keep the General Headquarters of the American Expeditionary Forces informed, the conflict over direct access to the Aircraft Production Board in Washington lessened when a permanent Interallied Advisory Committee for Aviation was formed as a subcommittee of the Interallied Aircraft Board. This

³¹ Patrick, Final Report, pp. 26-28.

³² After being relieved of his job as Chairman of the Joint Army and Navy Aircraft Committee, Col. Bolling requested an assignment at the front in a combat organization. He was given another staff job as a roving investigator. In March, 1918, he and his driver inadvertently approached too close to the German lines near Amiens. His car was fired on and he and his driver took refuge in a shell hole. Several German soldiers rushed up and ordered them to surrender, but Bolling drew his pistol and fired at them. They returned the fire and killed him. His driver was taken prisoner and was not released until after the Armistice. Patrick, The United States in the War, pp. 10-14.

subcommittee could not communicate with Washington at all, but under Colonel Halsey Dunwoody, who succeeded Bolling as Air Service spokesman, the recommendations of this subcommittee became binding on the respective Allied Services and virtually supplanted the Joint Army and Navy Aircraft Committee.³³

General Foulois's headquarters was located at Chaumont until February 17, 1918, when it and the other Air Service offices which had been operating in Paris transferred to Tours. Since much of the matériel which was purchased in Europe came from French factories located in or near Paris, the Supply Section returned to Paris where it began its functions later in April, 1918.³⁴

The organization of the Air Service on April 30, 1918, provided for the Chief of Air Service (Foulois) to function directly under the General Headquarters, American Expeditionary Forces. Exercising the Air Service Chief's authority as deputies were the several Assistant Chiefs of the Air Service in administrative functions, and the Comptroller in matters of property and accountability.³⁵

The following divisions of functions were made: Training Section, headed by Lieutenant Colonel Walter G. Kilner, was in charge of all aviation schools; Personnel Section, headed by Lieutenant Colonel Gonzales S. Bingham, was in control of the Air Service Replacement

³³"Organization of the Air Service, American Expeditionary Forces," 1917, A, Hy AS AEF, Vol. 1, p. 105.

³⁴Patrick, Final Report, p. 30.

³⁵"Organization of the Air Service, American Expeditionary Forces," 1917, A, Hy AS AEF, Vol. 1, p. 2.

Concentration Barracks at St. Maxient; Transportation Section, headed by Major George A. Robertson, took charge of all transportation; Supply Section, headed by Colonel Halsey Dunwoody, operated the various warehouses, depots, and parks which were in the process of development in the Services of Supply (formerly designated the Lines of Communication; Assembly, Salvage, and Repair Section, headed by Major W. C. Allen (later was designated Production and Maintenance Division and combined with Supply); and the Balloon, Radio, Photographic, and Information Sections, operated under one head, Colonel Charles Chandler.³⁶

The I Corps, American Expeditionary Forces, was organized on January 15, 1918, to provide administrative direction for all American troops then on the French front. It was commanded by Major General Hunter Liggett (one of the few air-minded officers in the American Expeditionary Forces). Colonel William Mitchell was appointed Chief of Air Service, I Corps, and set up his headquarters at Neufchâteau, in the Department of Vosges, later that same month.³⁷

When the first American aero squadrons were sent to the front in April, 1918, they went initially to the quiet Toul sector; Colonel Mitchell then moved his headquarters to Toul where the Air Service of the I Corps operated under the tactical command of the French Eighth Army and under the administrative command of the American I Corps.

³⁶ Memo, Headquarters, Services of Supply, Office of the Chief of Air Service, AEF, April 30, 1918, in Benjamin D. Foulois, "The Air Service, American Expeditionary Forces, 1917-1918," 1924, p. 26, in Foulois Collection, USAF HD Archives.

³⁷ General Order Number 9, General Headquarters, American Expeditionary Forces, January 15, 1918.

The French assigned to the I Corps Air Service a sector of the front for which the Americans were to be responsible. At this time, since the American Air Service was so small, pursuit in addition to the observation aviation was assigned to the I Corps Air Service.³⁸

On May 29, 1918, Brigadier General Mason M. Patrick was appointed Chief of the Air Service, American Expeditionary Forces, relieving General Benjamin D. Foulois, who was appointed Chief of Air Service, First Army.³⁹ From June, 1918, until the end of the war the function of the divisions and sections of the aviation command were prescribed by memoranda issued from the Office of the Chief of Air Service, American Expeditionary Forces. The organization first prescribed by General Patrick was as follows: Chief of Air Service, in charge of all activities, General Mason M. Patrick; Chief of Air Service, First Army, in charge of operations, General Benjamin D. Foulois; Assistant Chief of Air Service at General Headquarters, Colonel Wilson B. Burtt; Assistant Chief of Air Service at Tours, Headquarters of the Services of Supply, Colonel Henry C. Whitehead; Assistant Chief of Air Service, Advance Section, Services of Supply, charged with selection of airdromes, parks, and depot sites, Colonel Robert O. Van Horn; Assistant Chief of Air Service, Paris, in charge

³⁸"History of the Development of Air Service Command at the Front," C, Hy AS AEF, Vol. 1, p. 3.

³⁹General Order Number 81, General Headquarters, American Expeditionary Forces, May 29, 1918; "Résumé, Office of the Chief of Air Service, Tours," 1918, A, Hy AS AEF, Vol. 16, p. 64. Gen. Patrick was an experienced administrator, having served many years in the Corps of Engineers. He had never flown in an airplane prior to his appointment as Chief of Air Service, American Expeditionary Forces.

of supply and technical matters, Lieutenant Colonel Halsey Dunwoody; Officer in Charge of Training, Lieutenant Colonel Walter G. Kilner; Officer in Charge of Balloon, Radio, and Photography, Colonel Charles Chandler; Coordination Section, to assist the Chief of Air Service in plans, estimates, and programs, Major Harry A. Toulmin, Jr.; and a Strategic Section, composed of the Chief of Air Service, Chief of Air Service First Army, Assistant Chief of Air Service General Headquarters, Officer in Charge of Supply, Officer in Charge of Training, Officer in Charge of Balloons, General Staff representative to the Air Service, and the Officer in Charge of the Coordination Section, who acted as secretary.⁴⁰ Two more sections were added later: Assembly, Salvage, and Repair, headed by Major William H. Allen; and Transportation, headed by Major George A. Robertson.

In view of the fact that the American First Army was not officially created until August 10, 1918, General Foulois's assignment seems a little premature. Nevertheless, after being appointed Chief of Air Service, First Army, Foulois proceeded to Toul to take over the command of the front from Colonel William Mitchell.⁴¹ There was some disagreement between these two officers, and Foulois recommended that Mitchell be relieved and be returned to the United States. General Pershing, who was impressed by Colonel Mitchell's ability to get things

⁴⁰ Memo Number 17, Office of the Chief of Air Service, American Expeditionary Forces, June 10, 1918, in A, Hy AS AEF, Vol. 9, pp. 101-102.

⁴¹ The sources do not indicate just what position Mitchell held at this time. Presumably he was Commander of Air Service, I Corps. See General Order Number 81, General Headquarters, American Expeditionary Forces, May 29, 1918.

done, retained Mitchell in his post but asked him to go to Foulois and tell him that he was anxious to cooperate. The Commander-in-Chief also requested Foulois to meet Mitchell more than half way. Foulois complied with Pershing's wishes by asking Mitchell to serve on his staff in the most important post--that of operations assistant. Colonel Mitchell accepted the position but admitted frankly that he would rather have a tactical command. Foulois granted Mitchell's wish on June 27, 1918, by organizing on a tentative basis the 1st Brigade Air Service, to be composed of both observation and pursuit squadrons, and putting Mitchell in command.⁴²

A few days later the movement of American troops from the Toul Sector to the area around Château Thierry began, and Colonel Mitchell was ordered to proceed to that area for duty in connection with the tactical and technical supervision of all Air Service units designated for service there. Immediately there were reports of friction between Mitchell and the officers of the I Corps. It seems that Mitchell had tried to assume control of tactical Air Service units which were directly under the command of the Commanding General, I Corps. After an investigation, Foulois upheld Mitchell's decision. Meanwhile, the Inspector General of the American Expeditionary Forces had reported the undesirability of the brigade organization as then constituted.

⁴² See Enclosure D, "Lack of cooperation between . . . Mitchell (while serving as Air Service Commander, I, Corps) and . . . Foulois . . . (while serving as Chief of Air Service, American Expeditionary Forces, 1917-1918," 1924, pp. 49-58, in Foulois Collection, USAF HD Archives. For Mitchell's version of this episode, cf. letter from Mitchell to Foulois, dated July 19, 1918, in Mitchell, Memoirs of World War I, pp. 228-231.

The 1st Brigade Air Service continued to exist on paper only, for it was not abolished until July 24, 1918. On the following day General Foulois commended Colonel Mitchell to the Commander-in-Chief of the American Expeditionary Forces, General Pershing, and recommended that Mitchell be given his own post of Chief of Air Service, First Army.⁴³ On the same day, Foulois requested that he be relieved from his duty as Chief of Air Service, First Army, and be assigned to duty as Assistant Chief of Air Service, Operations, American Expeditionary Forces. His reasons for this action were to demonstrate effectively to Colonel Mitchell that in spite of their previous difficulties, Foulois appreciated and recognized Mitchell's good qualities and efficiency; to show his loyalty to Pershing by cooperating to the fullest extent with Mitchell, regardless of his own personal desires and ambitions; and to put his knowledge and experience at General Patrick's disposal. A short time later, Mitchell was given Foulois's job as Chief of Air Service, First Army, and Foulois was directed to report to the Chief of Air Service, American Expeditionary Forces, General Patrick, for duty as his assistant.⁴⁴

On August 5, 1918, General Patrick ordered Foulois to proceed to Colombey-les-Belles and to supervise and expedite Air Service activities in the Zone of Advance. Foulois carefully studied the

⁴³Letter, to the Commander-in-Chief, AEF, from the Chief of Air Service, First Army, July 25, 1918, as printed in ibid., p. 25.

⁴⁴General Order Number 120, General Headquarters, American Expeditionary Forces, France, July 24, 1918; the First Army was organized on August 10, 1918.

battle plans for the St. Mihiel operations and quickly recognized that these plans envisaged combined Air Service operations on a scale never before equalled at any time during the war. St. Mihiel was to be the first action in which complete army control rested in the hands of the Americans. The success of American Air Service units in this operation depended on a continuous supply of matériel and personnel to bring them up to full strength and keep them there. Foulois recommended the steps necessary to meet this emergency to General Patrick.⁴⁵

On August 27, 1918, Foulois was appointed Assistant Chief, Air Service, Zone of Advance, with all tactical Air Service units in the Zone of Advance not otherwise assigned placed under his command. This was made possible by the establishment on the same day of the General Headquarters Air Reserve, to which all new units were assigned before going to the front. Consequently all Air Service units ready to be sent to the Zone of Advance were assigned by Foulois and deficiencies in personnel and matériel were taken care of by him. Requests for personnel and equipment also were submitted to Foulois. This eliminated difficulties between Air Service units and Air Service Section, Services of Supply. Reserve supplies of personnel and matériel were concentrated at the 1st Air Depot, Colombey-les-Belles, from which all Air Service units in the Toul and Verdun areas could be supplied on a few hours' notice.⁴⁶

⁴⁵ Benjamin D. Foulois, "Personal Service Record, 1898-1919," 1919, p. 36, in Foulois Collection, USAF HD Archives.

⁴⁶ General Order Number 142, General Headquarters, American Expeditionary Forces, France, August 27, 1918.

While these preparations were going on in anticipation of the St. Mihiel offensive, General Foulois learned of the probability that this operation would be followed immediately by an offensive in the Argonne. To meet the supply demands of such operations a modification and amplification of the supply procedures was inaugurated. An additional reserve depot was established at Behonne, a short distance in the rear of the Argonne area. Personnel were assigned and airplanes, engines, and spare parts were immediately requisitioned from the Supply Section in Paris.

Largely by the efforts of Foulois and the officers under him, the necessary personnel and matériel to meet the situation were in position when the troops went "over the top" at St. Mihiel. From that time until the close of combat operations on November 11, 1918, Air Service units operating on the front were kept up to full strength at all times, making possible successful aerial operations in the St. Mihiel and Meuse-Argonne campaigns. Foulois also established an Air Service inspection unit which had no authority to compel corrective measures until October, 1918, when this power was granted. The inspectors also instructed inexperienced personnel in the care, repair, and maintenance of material, which made possible a great saving in equipment and lives.⁴⁷

By November 11, 1918, the organization of the headquarters of the American Expeditionary Forces Air Service had changed considerably. At its head was General Mason M. Patrick, who as Chief of Air Service, American Expeditionary Forces, was responsible to the Commander-in-

⁴⁷Benjamin D. Foulois, "Personal Service Record, 1898-1919," 1919, p. 40, in Foulois Collection, USAF HD Archives.

Chief (General Pershing) for the organization, training, matériel, and all other matters affecting the efficiency of the Air Service. The official headquarters of the Air Service was at General Headquarters in Paris,⁴⁸ and was under the immediate supervision of Colonel Henry C. Whitehead, the Chief of Staff, Air Service. The Chief of Air Service, American Expeditionary Forces, established all general policies. For the administration of matters not affecting policies there were two Assistant Chiefs of Air Service: General Foulois at the Headquarters, Services of Supply, at Tours; and Colonel Halsey Dunwoody in Paris. There were also representatives of the Air Service in London and Rome. Colonel Clarence R. Day was charged with the responsibility for Air Service matters in the United Kingdom, while Major Robert Glendinning had similar duties in Italy. The Paris office maintained liaison with the Allies and with the Air Service of the United States Navy.⁴⁹

General Foulois, the Assistant Chief of Air Service at Services of Supply headquarters, had charge of all personnel records, the supervision of training, and the administration of the Balloon Division and of the Air Service centers in the Services of Supply. The most important sections of this staff were the Training Section headed by Colonel Walter G. Kilner; the Balloon, Photographic, and Radio Section headed by Colonel Charles Chandler; the Personnel Section under

⁴⁸ Headquarters, American Expeditionary Forces, was redesignated General Headquarters, American Expeditionary Forces by General Order Number 11, Headquarters, American Expeditionary Forces, France, January 17, 1918.

⁴⁹ "Organization of the Air Service, American Expeditionary Forces," 1917, A, Hy AS AEF, Vol. 1, p. 4.

Lieutenant Colonel George W. De Armond; the Information Section headed by Captain E. L. Jones; and the Cables Section under Major James E. Chaney.⁵⁰

The Assistant Chief of Air Service, Paris, Colonel Halsey Dunwoody, was in command of all Air Service personnel in that city and was also Chief of Supply. His assistant and Chief of the Supply Section was Major J. M. Satterfield. Colonel Dunwoody's most important duties were those connected with the supply of aviation material. He was responsible for providing the matériel and equipment necessary for carrying out the Air Service program. He was charged with making and supervising contracts with Allied and neutral governments and with individual concerns; receiving, assembling, and dispatching airplanes, engines, and war equipment secured from all sources, including the United States. Also under Dunwoody's supervision were the Technical Section and the Night Bombardment Section. The Technical Section, headed by Lieutenant Colonel E. J. Hall, supplied advice on engineering questions, provided data and estimates for proposed developments, and was charged with acceptance, inspection, and testing of new airplanes and engines. The Night Bombardment Section under Colonel Ambrose Monell supervised the American night bombardment program and worked in close accord with the other Air Service sections concerned in this project. Its London office was charged with training flying and mechanic personnel in England and with assembly in British plants of Handley-Page airplanes built in the United States.⁵¹

⁵⁰ Ibid., p. 5.

⁵¹ Ibid., p. 4.

The American Expeditionary Forces First Army, organized on August 10, 1918,⁵² increased in size to such an extent that on October 10, 1918, the Second Army was created from some experienced units of the First Army augmented by a number of newly arrived organizations.⁵³ General Pershing advised General Patrick that he wanted Brigadier General William Mitchell to command the aerial fighting on the front, and Patrick designated Mitchell Chief of Air Service, Army Group, on October 14, 1918.⁵⁴ Mitchell established his office at Ligny-en-Barrois and was prepared to handle the Air Services of both the First and Second Armies. In order that there might be an authorization of Mitchell's new office, a suggested Table of Organization for the Office of the Chief of Air Service, Army Group, was submitted to the General Staff for approval. The General Staff refused to acknowledge the correctness of the principle of an Air Service Commander for an Army Group and the suggested Table of Organization was never approved. Mitchell, however, continued in charge of the Air Service on the front. On October 10, 1918, Colonel Thomas Milling was appointed Chief of Air Service, First Army.⁵⁵ Four days later Colonel Frank P. Lahm became Chief of Air Service, Second Army, with headquarters at Toul.⁵⁶

⁵²General Order Number 120, General Headquarters, American Expeditionary Forces, July 24, 1918.

⁵³General Order Number 175, General Headquarters, American Expeditionary Forces, France, October 10, 1918.

⁵⁴Special Order Number 287, General Headquarters, American Expeditionary Forces, France, October 14, 1918.

⁵⁵General Order Number 175, General Headquarters, American Expeditionary Forces, France, October 10, 1918.

⁵⁶"History of the Development of Air Service Command on the Front," C, Hy AS AEF, Vol. 1, pp. 3-4.

First Army Organization

On November 11, 1918, the Air Service of the First Army was headed by the Chief of Air Service, First Army, Colonel Thomas Milling. Directly under him were the Corps Observation Wing; the First Army Observation Group; the III Corps Observation Group; the VII Corps Observation Group; the 1st Pursuit Wing; the 1st Pursuit Group; and the 1st Balloon Wing.⁵⁷

The Corps Observation Wing, commanded by Major Melvin A. Hall, was composed of the I and V Corps Observation Groups. The I Corps Observation Group, commanded by First Lieutenant Arthur J. Coyle, was made up of the 1st, 12th, and 50th Observation Squadrons; while the V Corps Observation Group, commanded by Major Martin F. Scanlon, was composed of the 99th and 104th American Observation Squadrons, and two French Squadrons, the 214th and 215th.⁵⁸

The First Army Observation Group, headed by Major John N. Reynolds, was composed of the 9th Night Observation Squadron and the 24th and 91st Day Observation Squadrons. The III Corps Observation Group, headed by Captain William J. Schieffelin, Jr., contained the American 90th and 186th Observation Squadrons and the French 205th and 284th Squadrons.⁵⁹ The VII Corps Observation Group, which did not get into action, was commanded by Major Howard C. Davidson; this unit had

⁵⁷ War Department, Order of Battle, I, 81.

⁵⁸ Ibid., p. 83.

⁵⁹ "Report of the III Corps Observation Group," 1918, N, Hy AS AEF, Vol. 18, pp. 3-4.

only one squadron, the 88th Observation Squadron, which was transferred from the III Corps Observation Group on November 7, 1918.⁶⁰

The 1st Pursuit Wing, headed by Colonel Bert M. Atkinson,⁶¹ was composed of the 2d and 3d Pursuit Groups and the 1st Day Bombardment Group. There were four squadrons in the 2d Pursuit Group: the 13th, 22d, 49th, and 139th Pursuit Squadrons. This Group was commanded by Lieutenant Colonel Davenport Johnson. The 3d Pursuit Group, commanded by Lieutenant Colonel William Thaw, was made up of the 28th, 93d, 103d, and 213th Pursuit Squadrons. The 1st Day Bombardment Group, commanded by Major James L. Dunsworth, consisted of the 155th Night Bombardment Squadron, and the 11th, 20th, 96th, and 166th Day Bombardment Squadrons. The 1st Pursuit Group, commanded by Major Harold E. Hartney, was composed of the 27th, 94th, 95th, and 147th Day Pursuit Squadrons and the 185th Night Pursuit Squadron.⁶²

The 1st Balloon Wing, headed by Captain Allan P. McFarland, contained the 1st, 2d, and 5th Balloon Companies under the I Corps Balloon Group; the 3d, 4th, 9th, and 42d Balloon Companies under the III Corps Balloon Group; and the 6th, 7th, 8th, and 12th Balloon Companies under the V Corps Balloon Group.⁶³

⁶⁰"Historical Account of the Organization and Functioning of the VII Corps Air Service," 1918, N, Hy AS AEF, Vol. 23, pp. 2-3.

⁶¹"Roster of Officers of Headquarters, 1st Pursuit Wing, Air Service: From the Time of Its Organization to the Present Date," November 18, 1918, N, Hy AS AEF, Vol. 7, p. 3.

⁶²"Diagram of First Army Flying Squadrons at the Front," 1918, C, Hy AS AEF, Vol. 3, p. 449.

⁶³Marc A. Lagan, "History of Balloons, First Army," 1918, F, Hy AS AEF, Vol. 1, p. 247.

Second Army Air Service

The organization of the Second Army was never as complete as that of the First Army. On November 11, 1918, Colonel Frank P. Lahm was Chief of Air Service, Second Army,⁶⁴ and his command was made up of the IV Corps Observation Group; VI Corps Observation Group; French II Colonial Corps Observation Group; the 2d Day Bombardment Group; the 4th Pursuit Group; and the Balloon Wing, Second Army.

The IV Corps Observation Group, commanded by Major Harry B. Anderson (later succeeded by Major Edward C. Hoffman), was composed of the 135th Observation Squadron from the First Army, the 168th and 85th Observation Squadrons,⁶⁵ and later the 258th (also transferred from the First Army) which did not get into service. The VI Corps Observation Group, operating from Saizerais airdrome and headed by Major Joseph T. McNarney, was made up of the 8th Observation Squadron from the IV Corps Observation Group, and the newly arrived 354th Observation Squadron.⁶⁶ The French II Colonial Corps Observation Group, commanded by Major Delanney of the French Army, stationed at St. Mihiel airdrome, was composed of the 28th, 47th, and 277th French Observation Squadrons.

The 2d Day Bombardment Group, located at Ourches airdrome and

⁶⁴In January, 1919, the Chief of Air Service in the First and Second Armies traded positions. Col. Lahm became Chief of Air Service, First Army, and Col. Milling Chief of Air Service, Second Army.

⁶⁵The newly organized 85th Observation Squadron was later assigned to the Second Army Observation Group after making only two flights over the lines with the IV Corps Observation Group.

⁶⁶War Department, Order of Battle, I, 151.

commanded by Major George E. A. Reinburg, was composed of two recently arrived squadrons, the 100th and 163d Bombardment Squadrons, which had not taken part in any combat operations by November 11, 1918. The 4th Pursuit Group, stationed at Toul, was made up of two new squadrons, the 141st and 25th Pursuit Squadrons. In November the 17th and 143th Pursuit Squadrons (organizations which had been working with the British) joined the 4th Pursuit Group which was commanded by Major Charles J. Biddle. The 5th Pursuit Group, not formed until November 16, 1918, was commanded first by Captain D. L. Hill and later by Major Maxwell Kirby. It was composed of the 41st, 138th, and 638th Pursuit Squadrons, all of which were under orders to advanced positions when hostilities ceased. The 6th Pursuit Group, which was to have been in the Second Army Pursuit Wing, had not been organized when the war ended on November 11. The Second Army Observation Group, which was not organized until November 19, 1918, consisted of the 35th and 278th Observation Squadrons.⁶⁷

The Balloon Wing of the Second Army, commanded by Major John H. Jouett, included the IV Corps Balloon Group commanded by Captain Paul Patterson, which included the 15th, 16th, and 69th Balloon Companies; the VI Corps Balloon Group made up of the 10th Balloon Company and commanded by Major John G. Thornell; and the French II Colonial Corps Balloon Group under Captain Caillot consisted of the French 20th and

⁶⁷ "Second Army Air Service," 1918, C, Hy AS AEF, Vol. 5, pp. 2-4; 10-13.

52d Balloon Companies.⁶⁸

Balloon Organization

Major Frank P. Lahm, who arrived in France in September, 1917, was the first American balloon officer to reach Europe. Major Lahm immediately began to secure information about the organization and employment of balloons from the British and French. Based on the advice of these Allied sources and on his own study of the problem of preparing for the arrival of American balloon troops, he made two recommendations to the Headquarters, American Expeditionary Forces. The first proposal--to establish a balloon personnel depot at Toul, using the buildings of the French balloon service not occupied at that time--was disapproved by Pershing's staff. A recommendation for the establishment of a balloon school near the French balloon training grounds at Vadenay was approved and carried to completion.⁶⁹

Colonel Charles Chandler, who had been in charge of the Balloon Division in Washington, arrived in France with General Foulois on November 12, 1917, and was put in charge of the Balloon Section in Paris. Assisted by Major John H. Jouett, Colonel Chandler planned the procurement and delivery of balloons and equipment from the French and initiated the construction of a balloon repair depot at Is-sur-Tille.⁷⁰

⁶⁸ John H. Jouett, Commander of Balloons, Second Army, "History of Balloons, Second Army," 1918, F, Hy AS AEF, Vol. 1, pp. 268-279.

⁶⁹ Charles Chandler, "Report of the Balloon Section AEF," December 31, 1918, I, enclosures A and B, in USAF HD Archives.

⁷⁰ Ibid., pp. 1-2.

Meanwhile, Major Frank Lahm became the representative of the Balloon Section at Headquarters, American Expeditionary Forces. He moved from Paris to Colombey-les-Belles on February 23, 1918, when he became balloon representative for the Air Service, Advance Section, Services of Supply. This assignment gave him supervision over the combat training of balloon companies, which would be done in a quiet sector before assignment to tactical units on the front.⁷¹

The 1st, 2d, 3d, and 4th Balloon Companies, under the command of Major John A. Paegelow, arrived in France on December 28, 1917, and were immediately put into training. The first Americans to ascend in France went up on January 23, 1918, two balloons sharing the honor. The 2d Balloon Company became the first American Air Service unit to operate with American troops on the front in France. The unit reported to the I Corps on February 26, 1918. By April, the 1st and 4th Balloon Companies were at the front. Major Paegelow commanded the Balloon Group assigned to the First Army Headquarters; later when he became Wing Commander of the First Army he was relieved of the group command by Captain Allan P. McFarland, who occupied this position at the end of the war. On February 20, 1918, the 5th, 6th, 7th and 8th Balloon Companies arrived in France under the command of Major Arthur Boettcheer. These companies received training at artillery firing centers in the Services of Supply and went to the front in July, 1918.⁷²

⁷¹On August 10, 1918, Col. Lahm was assigned to General Staff duties. Later he became Chief of Air Service, Second Army. "Review of Balloon Activities," 1917-1918, O, Hy AS AEF, Vol. 6, p. 43.

⁷²Ibid., pp. 43 ff.

The American Expeditionary Forces Balloon School was established at Cupperly, France, in January, 1918. When the German advance took place in March, 1918, the school was moved from Cupperly to Marigny, where it remained for about a month, and then was moved to Camp Souge.⁷³

Shortly after the Second Army was organized, Major John H. Jouett was assigned as Wing Commander of the Army Balloons. Upon the organization of the Third Army for the occupation of Germany, the 1st Balloon Company was assigned to the III Corps and the 2d Balloon Company to the IV Corps with Lieutenant Colonel John A. Paegelow as Wing Commander of Balloons, Third Army.⁷⁴

At the end of the war there were 35 balloon companies in France: 33 had been sent from the United States; 2 had been organized in France from casuals. Since 10 of these companies did not arrive from the United States until November 3, 1918, there were actually 25 balloon companies serving troops at the front, working with artillery firing centers in the Services of Supply and operating the balloon schools. The 25 companies were assigned as follows: 17 companies (1st through 12th, the 15th, 16th, 42d, 43d, and 69th) were actively engaged at the front; 8 were on duty at the firing centers and at the balloon school. In addition to the balloon companies mentioned, the 101st Balloon Replacement Company and Wing Companies D, E, and F provided administration for units on detached service and balloon casuals in the

⁷³Charles Chandler, "Report of the Balloon Section AEF," December 31, 1918, I, pp. 2-3, in USAF HD Archives.

⁷⁴Ibid., pp. 3-4.

Services of Supply. There were also detachments for administration at each balloon group headquarters and Army Wing headquarters with designations corresponding to the corps units which they served.⁷⁵

⁷⁵Ibid., pp. 5-8.

PART I II

TRAINING FOR AERIAL OBSERVATION

CHAPTER VI

TRAINING FOR AERIAL OBSERVATION IN THE UNITED STATES

Introduction

In World War I the training segment of the United States Air Service activity, including the selection, training, and organization of flying forces, developed into an educational system on a scale much larger and more diverse than anyone anticipated. Teaching men to fly, to send messages by wireless, to operate machine guns in the air, to know artillery fire by its bursts, and to travel hundreds of miles by compass; teaching other men to detect enemy strategy from aerial photographs, and still others to repair airplane instruments, ignition systems, propellers, wings, and motors required a network of flying fields and schools, a large instructional force, and a maze of equipment and curricula.

None of these, practically speaking, was on hand at the outbreak of the war, and most serious of all was the lack of meaningful experience to show what was needed. The United States Army had never trained an aviator sufficiently to meet the demands of overseas aerial warfare and it had only a limited knowledge of the instruction necessary for radio, photography, and the other specialized skills needed for the proper utilization of military aircraft.

The Air Service called upon many outside organizations to aid

in the development of its training program. The National Advisory Committee for Aeronautics, several joint Army and Navy boards, and other agencies added their energies to the solving of training problems. Great Britain, France, and Italy established aviation missions which brought their years of experience to help solve problems confronted in Washington for the first time.

The French and British military advisors who came to the United States in April, 1917, reported the German mastery of the air. Of course, the air forces of the Allies had not been annihilated; but German observation flights could not be prevented, and Allied observation planes seemingly were unable to penetrate the outer lines of the enemy. France and Britain were reaching down to their last reserves of manpower, but they both had splendidly efficient systems of training. The United States had an abundance of manpower, but it had no experience. At first glance, it appeared as though the combination could not have been better. The Allies urged the Air Service to send overseas officers who would learn something about aviation at close range, but for months only a few were sent.

Consequently, when American pilots and observers arrived overseas they needed additional training. A large part of their instruction had been out of date when they received it. Furthermore, they had been trained far from artillery and infantry units, so that in action neither ground troops nor aviators knew what to do next. To be sure, conditions at the front were changing so rapidly that it was almost impossible to keep any system of training up to date, but at least there could have been some sort of training exercises with ground troops.

France, the pioneer in aerial observation, had attained the highest degree of efficiency in this area of training. Because the war was staged chiefly on French soil, was fought in accordance with French topography and under French artillery practices, France should have been the example. The training program developed for the United States was a sort of compromise between the British and French systems of training. Perhaps the Air Service compromised because the Americans could understand the British officers without borrowing an interpreter.

The tables of organization for an Air Service observation squadron in World War I authorized 43 officers (5 ground officers and 30 fliers, or 19 observation teams) and 186 enlisted men. Of the observers, 12 were for artillery work, 4 for infantry, 2 for the staff, and 1 to command the squadron. The enlisted men of the squadron were classified as follows: 1 expert airplane engine mechanic, 1 general airplane mechanic, 17 airplane riggers, 1 magneto mechanic, 18 general airplane repair men, 15 engine assemblers, 18 gunsmiths (armorers), 2 canvas workers, 3 general electricians, 1 tire repairer, 6 instrument repair men, 3 storage battery experts, 3 lathe operators, 4 radio constructors, 1 welder, 4 coppersmiths, 2 blacksmiths, 5 truckdrivers, 19 motorcycle riders, 5 automobile chauffeurs, 11 general mechanics, 9 carpenters, 1 painter, 3 stock keepers, 1 draftsman, 1 typist, 4 clerks, 1 radio operator, 6 cooks, and 2 buglers.¹

This list of skills when added to the list of other men who

¹United States, American Expeditionary Forces, Tables of Organization, Series F, Air Service, September 8, 1918, Table 606, Observation Squadron, Air Service, as printed in Department of the Army, United States Army in the World War, 1917-1919, I, 398.

worked on behalf of aviation, although not always attached to the Air Service, indicates that for every man in the air, approximately 50 men were required on the ground. While the Training Section played no role in the instruction of the medical, ordnance, and chemical specialists from other branches of the service that supported the work of aviation units, the diversity of training which came under the purview of the Air Service was an unprecedented challenge to its leaders.

Organization

Since aviation was such a highly technical field, it was obvious that an enormous amount of instruction would be necessary for the men who were to enter this service from civilian life. To provide the planning, execution, and supervision of this educational program the Training Section of the Aeronautical Division of the Signal Corps was formed. This later became the Training Section of the Division of Military Aeronautics and eventually the Air Service Training Section.² The responsibility for training flying and ground officers and establishing and maintaining schools for the instruction of enlisted men devolved upon this organization. Of the 131 commissioned officers on duty with the Air Service on April 6, 1917, only 35 were rated as flying officers--all junior military aviators. There were a number of line officers undergoing instruction at San Diego at this time; they were hurriedly graduated so that on August 1, 1917, there were 84 junior military aviators. These flying officers were assigned to the task of

²War Department, Order of Battle, III, Part 1, 96, 98, 99.

opening and organizing flying fields.³

On April 6, 1917, the United States Army had only three airfields suitable for flying training: Mineola, New York; San Diego, California; and Essington, Pennsylvania. Three more were selected, cleared, equipped, and made ready for flying in six weeks' time, and by the end of the war, over a score were in operation all over the country. The nature of the training conducted at these fields varied. March, Mather, Scott, Chanute, Barron, Carruthers, Rich, Eberts, Taylor, Payne, Kelly, Park, Souther, and Love Fields were devoted to primary training. Post, Call, and Langley Fields were flying schools for observers. Rockwell, Dorr, and Carlstrom Fields were used for pursuit and gunnery training. Ellington and Gerstner Fields were bombing schools. Taliaferro and Selfridge were aerial gunnery schools. Wilbur Wright Field was assigned to gunnery training and experimental and research work.⁴

³Army and Navy Journal, April 19, 1919, p. 1151.

⁴The following is a list of flying fields in the United States with the location and the date instruction was started. Barron Field, Fort Worth, Texas, December 1, 1918; Brooks Field, San Antonio, Texas, May 1, 1917; Call Field, Wichita Falls, Texas, December 1, 1917; Carlstrom Field, Arcadia, Florida, April 4, 1918; Carruthers Field, Fort Worth, Texas, December 1, 1917; Chanute Field, Rantoul, Illinois, July 14, 1917; Dorr Field, Arcadia, Florida, May 23, 1918; Eberts Field, Lonoke, Arkansas, April 15, 1918; Ellington Field, Houston, Texas, December 15, 1917; Gerstner Field, Lake Charles, Louisiana, December 15, 1917; Hazelhurst Field, Mineola, New York, June 16, 1916; Kelly Field, San Antonio, Texas, August 11, 1917; Langley Field, Hampton, Virginia, May 18, 1918; Love Field, Dallas, Texas, June 15, 1917; March Field, Riverside, Texas, June 15, 1918; Mather Field, Sacramento, California, June 17, 1918; Park Field, Millington, Tennessee, December 15, 1917; Payne Field, West Point, Mississippi, May 20, 1918; Post Field, Fort Sill, Oklahoma, September 15, 1917; Rich Field, Waco, Texas, December 15, 1917; Rockwell Field, San Diego, California, August, 1914; Scott Field, Belleville, Illinois, September 12, 1917; Selfridge Field,

Flying Training

Since the requirements were necessarily rigid, the selection of men for training as fliers was a complicated task. Volunteer examining boards were organized all over the country; 36 urban and 30 divisional boards examined a total of 38,777 men, of whom nearly half (18,004) were disqualified.⁵ The high caliber of flying students selected made their subsequent training both rapid and efficient.

Prior to entering flying training, the candidate was enrolled in a three months' course at a ground school, where, under strict military discipline, the cadets were indoctrinated in the basic elements of military aviation. The following ground schools, all opened May 17, 1917, and closed on the date given, were established and conducted by the Training Section: University of California, February 1, 1919; Cornell University, November 23, 1918; Georgia School of Technology, May 1, 1918; University of Illinois, November 23, 1918; Ohio State University, September 17, 1918; Massachusetts Institute of Technology, August 31, 1918; Princeton University, November 23, 1918; and the University of Texas, February 1, 1919. Initially, all of these schools were used for the training of aviation cadets. Later, however, this particular training was confined to Cornell, Princeton, the University of California, and the University of Texas; the other schools were

Mt. Clemmens, Michigan, July 14, 1917; Souther Field, Americus, Georgia, June 1, 1918; Taliaferro Field, Fort Worth, Texas, December 1, 1917; Taylor Field, Montgomery, Alabama, May 1, 1918; and Wilbur Wright Field, Fairfield, Ohio, July 14, 1917. War Department, Order of Battle, III, Part 1, 814-931.

⁵Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1386.

utilized for the training of ground officers in specialized work such as radiotelegraphy, photography, engineering, squadron supply work, and squadron adjutants.⁶

The actual flying instruction was divided into two phases: primary and advanced. The former course, which averaged about eight weeks, included a thorough introduction to the skills of operating airplanes. A demonstration of the cadet's ability to execute the simpler aerial maneuvers and to complete cross-country flights led to a second lieutenant's commission and the right to wear the reserve military aviator's wings. By June 30, 1918, 4,980 men had been graduated as reserve military aviators and were ready for final training; about 400 cadets had been disqualified as incapable of becoming fliers.⁷

The advanced training, however, presented infinitely more difficulties. It was not nearly so simple to teach the more complex stunts, formation flying, and aerial gunnery. Moreover, the highly specialized equipment necessary for this advanced training required considerable time for manufacture. Nevertheless, towards the end of 1918 three types of advanced schools were opened with what equipment was available, and by the end of the war they had graduated a total of almost a thousand observers, army corps pilots,⁸ and pursuit pilots.⁹

⁶Army and Navy Journal, April 19, 1919, p. 1151.

⁷Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1386.

⁸To be completely accurate, all pilots connected with observation squadrons were not army corps pilots. This, however, was the original title, and is used here to avoid repetition of the term "observation pilot."

⁹There were 464 observers, 389 army corps pilots, and 131 pursuit pilots graduated. Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1386.

An observers' school was opened at Post Field, Fort Sill, Oklahoma, early in September, 1917. The school was capable of instructing 315 students, but its capacity was never attained.¹⁰ Candidates for the observers' school were obtained solely from volunteers attending ground schools. Even if the observers' school had been filled, or even half filled, there would not have been enough planes for instructional purposes. On the date of American entrance into the war the entire United States Army had but 55 planes. They looked efficient, and they photographed beautifully; they could do almost anything but fly well.

In October, 1917, the War Department tried to inveigle National Guardsmen into applying for observation training, but their response was not enthusiastic. Their lack of interest may well have been due to the high requirements and to the low grades of commissions offered. The Guardsmen, who were never told, convincingly, what an observer's work was like, continued to share the public impression that observers were unimportant, and quite naturally they preferred to remain with their own regiments.

The failure to popularize the observers' course led eventually to the acquisition of personnel by arbitrary methods. In December, 1917, the War Department directed that 25 officers from the various divisional camps be sent each week to the Artillery Observation School at Fort Sill, Oklahoma, and be indefinitely attached to the Signal

¹⁰ War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, pp. 49-50.

Corps.¹¹ This plan was modified in January, 1918, when 15 artillery, 7 cavalry, and 3 infantry officers were detailed each week to the school.¹² Cadets who failed pilot training were asked to apply for observer training. Frequently the officers sent were not the best material; in February, 1918, Secretary of War Newton D. Baker directed that the men chosen be "only the most desirable type of young officers."¹³ In April, 1918, the rating of "aerial observer" and a distinctive insignia were authorized.¹⁴ This official recognition of the importance of the role of the observer and the need for selecting only the fittest students brought better incentives to the observers' training program.

In January, 1918, a complete curriculum for the observers' course was drawn up with the help of four members of the British Royal Flying Corps and two officers of the French Air Service. The complete course, as it was finally arranged, lasted about 23 weeks, and began with ground school instruction on general military matters, radio, machine guns, and the interpretation of aerial photographs at either Post, Call, or Langley Fields. Satisfactory pupils were then shipped to a two-week school of fire (the field artillery school at Fort Sill, Oklahoma, or the coast artillery school at Fort Monroe, Virginia) to

¹¹General Order Number 73, War Department, Washington, December 3, 1917.

¹²General Order Number 37, War Department, Washington, January 12, 1918.

¹³Memorandum, Office of the Secretary of War, Washington, February 21, 1918.

¹⁴General Order Number 88, War Department, Washington, April 18, 1918.

learn how to cooperate with the artillery; to observers' school for six weeks; and finally to an additional two weeks at aerial gunnery school for the final touches. The aerial gunnery schools at Ellington, Selfridge, Taliaferro, and Rockwell Fields graduated 2,295 men. The fully trained observer was required to be able to send and receive eight words a minute by telegraph code, to make 12 good aerial photographs on 18 assigned locations, to locate and direct artillery fire against enemy batteries, and to conduct a prearranged shoot without error.¹⁵

In the meantime, arrangements were made for army corps pilots to receive training in the operations of observation machines. These pilots were chosen from reserve military aviator course graduates and were given a four-week course which was also attended by the observers. Instruction was given to permanent pilot-observer teams. The pilots studied radio and gunnery and took the instruction given the observers in aerial liaison with the infantry and artillery, in addition to their flying training. Later, the pilots and observers spent two weeks together at the aerial gunnery schools.

It was difficult at first to obtain instructors with the proper qualifications. As the first classes graduated, the most promising students were then retained as teachers. The instructors had been arbitrarily detailed to training duty, and their own disappointment was acute, because the assignment meant that they would probably never get overseas. Aided by a few French and British officers, they

¹⁵ Sweetser, The American Air Service, pp. 116-117.

instructed as well as they could; but they knew only theory, and they could teach only what they knew. Considering the fact that the majority of instructors were merely graduate students who had never had combat experience, the flying training given Air Service students, in spite of its brevity, was well done. Later, special instructors' schools were opened at Gerstner Field in Louisiana and Brooks and Kelly Fields at San Antonio, Texas.¹⁶

During the early months of the war, most of the instruction in the United States was done by professional civilian pilots. About 70 civilian fliers were employed by the Air Service during 1917. After the turn of the year, the need for civilian flying instructors declined, due to the fact that a number of reserve military aviators had been trained as flying instructors. By January 1, 1918, hundreds of reserve military aviators were being graduated each week. The number of reserve military aviators graduated at all training fields in the United States by the end of the war was 8,689. The number of observers trained in the United States was 1,620; they were classified as follows: bombers, 417; fighting observers, 296; and artillery and infantry observers, 902.¹⁷

Stunt flying, an integral part of pilot and observer training, saved countless lives and accounted for many aerial victories. Combat in the air was not a long, drawn-out duel, with guns spitting fire incessantly; it consisted rather of a large amount of jockeying for

¹⁶"Instructor Schools," 1918, A, Hy AS AEF, Vol. 19, p. 282.

¹⁷Army and Navy Journal, April 19, 1919, p. 1151.

position and a few quick shots. The encounter was often finished in less than a minute, with the loser either falling out of control or scooting for home. The idea was not to blaze away at long range, but to come to close quarters, to get into a superior firing position, and then to shoot. Stunts were as necessary for defensive action as they were for offensive tactics.

The loop was generally the first stunt to be taught; it was the easiest to learn, and the least valuable in combat. Now and then a pilot who was pursued might loop in order to come back on the other fellow's tail and become the pursuer, but it was a risky venture: from the instant that the nose of the plane went up until it was pointing down again the ship was almost defenseless.

Aerial acrobatics, however, were all based on the loop, the bank, and the vrille. The loop itself, although rarely a good thing to execute in combat, was the antecedent of the renversement, the retournement, and the famous "Immelmann turn." Each of these maneuvers brought about the quickest possible change of direction; each maneuver started out as though for a loop but about half way up the loop the ship would slide over in a half vrille; in the renversement and the "Immelmann" it would go back in the opposite direction; in the retournement the plane would pick up the original direction again. The vrille, or "tail spin," was a stunt in which the plane tumbled down headlong like a match in a whirlpool. This was the way the heavily motored aircraft of World War I acted when out of control. Consequently, the vrille was used to delude the enemy into thinking he had won a battle. At a lower altitude the pilot would level the plane and

scamper.¹⁸

There were many variations developed from these basic maneuvers, but they all worked on the same principles and all were designed to achieve the same result--to change the course, or to change the altitude, with the least possible delay. Both pilot and observer had to be trained to come out of these stunts, or out of a succession of them, with unimpaired nerves and with no loss of fighting instinct.

Observation planes often flew at altitudes of only a few hundred feet. If suddenly attacked--and it was hardly worth attacking at any altitude except with the advantage of surprise--the observation team usually attempted to escape. Observers were supposed to place the completion of the mission before voluntary combat. To escape would probably require quick execution of a stunt; and almost every aerial acrobatic maneuver resulted in a rapid loss of altitude. The observer and his pilot had to be well trained to face this dangerous situation. Therefore, from the beginning of their training, both the pilot and the observer were taught to be on the alert constantly for other machines. This meant looking both for friends and enemies. Other ships in the sky were presumed hostile until proved otherwise, for although they might be a mile away when first sighted, ten seconds later they might begin firing.¹⁹

One of the most difficult segments of flying training was the 300-mile problem in aerial navigation over unfamiliar country. It

¹⁸ Morris and Smith, Ceiling Unlimited, pp. 164-165.

¹⁹ William Mitchell, "Routine Procedure of Air Service Units," August 19, 1918, p. 1, in USAF HD Archives.

required a considerable amount of instruction to estimate the prevailing winds, to plot the course, allowing for the drift of the plane in the wind, and to hold a compass course on every leg of the journey.

By the spring of 1918 the Air Service hoped to train all pilots and observers in the United States where the necessary facilities and supplies could be obtained easily. Plans were formulated to organize provisional squadrons, wings, and brigades in the United States and give training to the larger units with their own administrative officers and enlisted personnel. After their arrival in France, they would then be able to go immediately to the front as combat-ready units of the American Expeditionary Forces.²⁰

Training of Ground Personnel

Besides the pilots and observers, a variety of nonflying personnel, absolutely essential to the operation of Air Service units, could be secured only after a detailed course of instruction. The first training school for ground officers was opened at Kelly Field, San Antonio, Texas, on September 1, 1917. Of the 892 candidates for ground officers' commissions enrolled during the continuance of the school, 415 were commissioned, 37 were discharged, and 21 were returned to their organizations.²¹ On January 17, 1918, when the school closed,

²⁰Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1386-1387.

²¹"Schools Established for the Air Service Training Program, 1917-1920," 1920, p. 62, in USAF HD Archives.

the remainder were sent to the Supply Officers' School at Massachusetts Institute of Technology and the School for Adjutants at Ohio State University. The total number of candidates trained and commissioned at these schools were: Supply Officers' School, Georgia School of Technology, 852; Engineer Officers' School, Massachusetts Institute of Technology, 726; and Adjutants' School, Ohio State University, 789.²²

A six-week course for armament officers and men to care for machine guns and bombs was opened at Wilbur Wright Field, Fairfield, Ohio, on April 15, 1918. It graduated 202 officers and 465 men,²³ most of whom were sent overseas. A special course for compass officers was opened at Camp Dick, Texas, on April 10, 1918, and graduated 53 compass experts. Another course, also at Camp Dick, was started at the same time for a score of navigation officers.²⁴

Radio also required special instruction, with courses and instructors for all fliers, for the crews receiving the messages on the ground, and for the men responsible for maintenance of the radio equipment. At the outset, volunteer civilians, each with his own methods of instruction, carried on this technical training. By the end of the war the courses of radio instruction were standardized at all Air Service training installations. Maryland State College trained 73 radio officers and 351 officers were instructed at the radio school at Columbia University which opened in April, 1918. Graduates of these schools were given a three-week course in the installation of airplane radios at Post Field, Fort Sill, Oklahoma, and a two-week course in

²²Ibid., pp. 73-80.

²³Ibid., p. 91.

²⁴Ibid., p. 108.

radiotelephony at Gerstner Field, Lake Charles, Louisiana. Four schools for training enlisted men in radio work were opened in the United States.²⁵

Aerial photography required a similar triple instruction--that for observers to operate the cameras in the air, intelligence officers on the ground to interpret them, and other men to aid in developing, printing, and enlarging photographs and keeping the equipment in serviceable condition. The United States had no aerial cameras at the outbreak of the war. The first Air Service school of aerial photography was opened at Langley Field, Virginia, on October 19, 1917. Another photography school was opened at Cornell University on January 9, 1918. A total of 207 photographic officers were trained and commissioned at these schools.²⁶

One of the most serious problems faced by the United States Air Service in World War I was the slow development of the ground force needed to keep airplanes and engines in prime condition: repairing minor fabric tears, tightening up wires, strengthening struts, and making sure that no airman went up in an unsafe machine. American mechanics were quite unaccustomed to the delicacy and carefulness required to service airplanes. Moreover, many of the most skilled mechanics had been drained off by the draft, by enlistment, or by other war industries.

Consequently, it was necessary to establish a whole series of schools to train aviation mechanics for the Air Service. In the fall

²⁵ Ibid., p. 123.

²⁶ "History of the Photography Section," 1918, G, Hy AS AEF, Vol. 1, pp. 2-3.

of 1917, small detachments of mechanics were sent to factories to secure as much knowledge and experience as possible about the following: ignitions, magnetos, propellers, welding, instruments, sail-making, cabinet work, copper work, machine guns, and motors. While about 2,000 men were being graduated from 17 courses at 34 different schools of this type, courses were established at five northern flying fields closed for flying during the winter. With 2,500 graduated here, still more detailed courses were opened at four large mechanics' schools, which added another 5,000 men. By the end of the war, two large and complete schools were in operation at Kelly Field, Texas, and St. Paul, Minnesota, capable of graduating 5,000 men every three months.²⁷

Balloon Training

After the United States entered the war, the commandant of the Balloon School at Fort Omaha, Major Charles Chandler, along with a few other experienced balloon officers, was ordered to Washington to organize a balloon service. Representatives were sent abroad and the foreign missions sent to America included balloon officers whose advice was of great assistance to Major Chandler.²⁸

The first program for balloon squadrons (later designated companies) drawn up in August, 1917, called for only 69 balloon squadrons at home and abroad.²⁹ By September, 1917, however, it was

²⁷ Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1388.

²⁸ Charles Chandler, "Balloon Section Report," I, 1-8, in USAF HD Archives.

²⁹ War Department, Order of Battle, III, Part 1, 127.

decided that a total of 200 balloon companies should be organized.³⁰ The number of men authorized for a balloon company was changed from time to time but was always between 90 and 180.³¹

The general procedures for training balloon officers were about the same as those used to train pilots and observers. The nature of the instruction and the methods of organization for the balloon service were, however, somewhat different. A policy of keeping them separate and distinct was pursued in matters relating to equipment, training, and personnel. The method of organization and assignment of observation companies to tactical units, which was the basis for the training program in the United States, was one group of five companies to each corps, and one wing of three groups to each army.

Candidates for commissions in the balloon service after passing an examining board were sent to balloon schools for five weeks of basic military training. The next step was a four-week elementary course which included the theory of ballooning, topography, meteorology, perspective, and communications. Those who successfully completed this course went on to become balloon observers or balloon maneuvering officers.

Observer cadets received an eight-week ground and air course in which they continued several of the subjects they had already started, and were also given instruction in observation of infantry combat as

³⁰ Ibid.

³¹ United States American Expeditionary Forces, Tables of Organization, Series F, Air Service, September 8, 1918, Table 609, Balloon Company, Air Service, in Department of the Army, United States Army in the World War, 1917-1919, I, 401.

assisted by the infantry, artillery, and other arms. Upon graduation the cadet was rated as an "aerial observer (balloon)"³² and was commissioned a second lieutenant. Further training of observers included additional field exercises in conjunction with artillery and infantry units and instruction in securing and interpreting aerial photographs. Balloon company commanders were selected from the graduates of observers' school and were given the instruction received by maneuvering officers.³³

The maneuvering officer's chief duty was to move the balloons from place to place. This required considerable skill and training since the balloons were frequently moved inflated. The "ground and air course" given the maneuvering officers lasted four weeks and included the study of rigging, winch, telephone, machine guns, aerostatics, and field maneuvering. Upon satisfactory completion of this course, the student was commissioned as a second lieutenant. This system of training was developed in 1917-1918 and was greatly influenced by the experience of the British and French balloon forces.³⁴

In the summer of 1917 the only balloon school in the United States was located at Fort Omaha, Nebraska. It had been recently reopened after complete abandonment the previous November. Accommodations for 15 officers and 400 men and the balloon shed, gas plant,

³²This rating was provided for in General Order Number 38, War Department, April 18, 1918.

³³War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, p. 89; War Department, Order of Battle, III, Part 1, 127.

³⁴War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, p. 89.

two obsolete captive balloons and some telephone material were utilized in the training that began in June, 1917. Within six months, however, the weather made this station unsuitable for training.³⁵ On May 26, 1917, the War Department approved a small balloon school at St. Louis, Missouri, operated by the Missouri Aeronautical Society. On October 23, the school moved to winter quarters at Brooks Field, San Antonio, Texas.³⁶ Two other balloon schools were established in 1917: Camp Lee Hall, Virginia, close to the heavy artillery training center at Camp Eustis, was opened in July for further training of observers; and the other balloon school was constructed in September near the Artillery Firing Center and School of Fire at Fort Sill, Oklahoma.³⁷

In January, 1918, Camp John Wise, near San Antonio, Texas, was established as a temporary balloon school; it was made a permanent school for maneuvering officers in March, 1918. An additional balloon school was established in June, 1918, at Ross Field at the foot of Mount Wilson, Arcadia, California, where candidates for balloon observers' commissions were sent. Congestion at several schools, caused by a delay in shipping trained balloon companies overseas, made it necessary to expand the capacities of these stations. In addition to these schools, a number of balloon companies were assigned to

³⁵ Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1389.

³⁶ "Missouri Aeronautical Society," Correspondence, 1917, Office of the Chief Signal Officer, Box 526, File No. 123.73, in the National Archives.

³⁷ Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1389.

artillery training camps for training in artillery cooperation, and 206 cadets received their primary training as balloonists at Massachusetts Institute of Technology. Up to November 11, 1918, 685 balloon officers were trained in the United States and 102 balloon companies were formed, of which 34 were sent overseas.³⁸

The "R"-type kite balloons, the kind most used by the United States in World War I, were made of rubberized silk or of high-grade cotton cloth and were 93 feet long and 28 feet in diameter. The wicker basket suspended from the balloon had a floor area of about 20 square feet, and offered the balloon observers little more room than the airplane observer enjoyed. There was no need for more space since there were no machine guns to look after and comparatively few instruments or other accessories to watch. The balloon and basket were usually anchored to a truck by a slim steel cable attached to a power winch; thus, the balloon could be raised or lowered quickly to avoid attacks from hostile airplanes or artillery, to suit the weather conditions, or to meet other needs of the observer.³⁹

The kite balloon,⁴⁰ invented by Captain Caquot of the French Army, looked like a sausage with elephant ears on one end. These ears served as stabilizers and kept the head of the balloon pointed into the wind. Earlier spherical balloons could not be controlled in this

³⁸Army and Navy Journal, April 19, 1919, p. 1152.

³⁹Theodore M. Knappen, Wings of War (New York: G. P. Putnam's Sons, 1920), pp. 227-230.

⁴⁰The kite type of balloon was called the "Caquot" by the French. The Germans, who also employed this type of balloon, called it a Drachen.

fashion, and were so pitched about by stiff breezes that there was little opportunity for the observer to conduct effective reconnaissance. Furthermore, the wind would often push a spherical balloon down low to the ground, whereas the kite balloon was pushed up by the wind in the same way that a kite is pushed up.

The first Air Service parachute jump was made on October 19, 1917, at Fort Omaha, Nebraska, from a balloon at a height of 1,500 feet.⁴¹ The parachute was packed in a canvas bag attached to the balloon basket and the weight of the jumper pulled out the silk canopy. Free type parachutes, the familiar harness and pack outfits later worn by aviators, were not used by American flying personnel during World War I.⁴² Some free type parachutes were tested with dummies at Fort Omaha, but these were not equipped with the modern rip cord. Instead, a small pilot chute pulled the big chute free of the pack. Training with the attached type of parachute became a routine part of the balloon course in the United States.

The enlisted personnel of balloon companies also received their specialized training in the United States. Besides instruction in regular military duties, 50 per cent of the enlisted men of balloon companies were given special training as mechanical engineers, riggers,

⁴¹Moore, U.S. Airpower, pp. 62-63.

⁴²Although the attached type of parachute was widely used by Air Service balloonists in World War I, American aviators were not equipped with them. Pilots and observers considered the attached type chutes too dangerous to use from a plane. Free type chutes had not been perfected. German pilots, however, were using the attached type parachute in the latter part of the war. Their chutes were attached under the planes so that they would not foul on the wings. Arnold, Global Mission, p. 49.

telephone repair men, welders, radio mechanics, and draftsmen.⁴³

Conclusion

By the end of World War I, the United States Air Service had developed an education system complete in all the details necessary to meet its intricate needs. Fields, curricula, instructors, and equipment were on hand for the most diverse courses, and thousands of men trained to deal with the difficulties of operating airplanes and balloons were being graduated. The development of the Air Service training program was carried out under sizable difficulties. Training and production schedules were not properly coordinated. Time was lost in obtaining the authority necessary to build new airfields and in securing additional funds and personnel. Moreover, work had to be done while the offices in Washington were being moved half a dozen times and while personnel were being shifted between Washington, the training fields, and overseas.

The total flying and ground personnel, both commissioned and enlisted, who received technical instruction in schools established in the United States by the Air Service's Training Section were: flying officers, 13,144; ground officers, 3,245; enlisted men, 24,512; total, 40,901. This figure is exclusive of the men instructed in special courses conducted by commanding officers of Air Service installations. In November, 1918, an additional 20,976 students were enrolled in the

⁴³Each balloon company had its own anti-aircraft unit attached to it. War Department, The Signal Corps and Air Service: A Study of Their Expansion in the U.S., 1917-1918, pp. 89-90.

more than 50 schools in the United States.⁴⁴ When it is considered that schools for training nearly 41,000 men had to be established, equipped, and staffed with instructors, the magnitude of the achievement of Air Service training in the United States can be appreciated.⁴⁵ Despite the impressiveness of the Air Service training statistics, the expansion and development was much more complicated and much less rapid than expected.

The total enrollment of cadets who had been candidates for commissions as flying officers in all the schools was 22,689. Of this number 15,628 entered flying schools in the United States; 1791 were sent overseas directly from ground school and trained in the flying schools of England, France, and Italy; 5,149 were discharged or transferred from ground schools.⁴⁶ Among the reasons given for these terminations of training were mental deficiencies, physical disabilities, disciplinary actions, and the reduction of cadet pay in March, 1918, from \$100 per month to \$33 per month. The signing of the Armistice

⁴⁴Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1390. In addition to the men trained in the United States and Europe, 79 cadets from ground schools and 86 cadets from the officers' training camps were assigned to the British Royal Flying Corps in Canada for flying training, the first cadet reporting to Toronto on July 9, 1917. Jones, The War in the Air, V, 464-467.

⁴⁵When the United States entered World War I there were 131 officers in the Air Service; at the end of hostilities there were 14,230. Similarly, the enlisted strength jumped from 1,087 to 124,766. The number of men in or awaiting flying training increased from less than 100 to over 18,000. Indeed, by November 11, 1918, the Air Service alone was larger than the United States Army had been at the outbreak of the war. "Training in the United States," 1918, A, Hy AS AEF, Vol. 16, p. 113.

⁴⁶Report of the Director of Military Aeronautics in War Department, Annual Reports, 1918, I, 1390.

was also responsible for the resignation of a great number of cadets. At this time the Air Service gave candidates the option of asking for discharge or continuing their training until they were qualified reserve military aviators.⁴⁷

From the beginning of flying instruction in the United States up to and including November 11, 1918, the statistics on fatalities were as follows: total fatalities, 264; total hours flown, 811,072; hours flown per fatality, 3,072.24; number of trained reserve military aviators per fatality, 32.81.⁴⁸ For every training fatality a distance equal to seven times the earth's circumference was travelled. Regrettable as the accidents were, the Air Service felt that, considering the poor condition of the planes, the inexperience of the instructors, and the necessity of teaching rather dangerous stunts, this number of fatalities was not large. As a matter of fact, fatalities in American training were less than half those incurred by trainees in Allied countries. Both France and Britain thought that the American schools were too safe for the proper development of combat aviators. Britain lost one man to every 2,808.2 training hours. But when the United States Air Service got to the front, it lost three men while Britain and France were losing one. American fliers would probably have profited from more simulated combat in their training programs.

On June 4, 1918, American Expeditionary Forces Headquarters, in setting forth the quotas of trained Air Service personnel required

⁴⁷Special Order Number 98, Headquarters, Air Service, Washington, November 17, 1918.

⁴⁸"Training: Casualties, Accomplishments, Miscellaneous Remarks," 1918, A, Hy AS AEF, Vol. 16, p. 110.

overseas within the year, called for 13,314 observers.⁴⁹ It was a large order, inordinately large when it is realized that in May, 1918, only 266 students of observation were actually under instruction in the United States.⁵⁰ Although a few hundred men had been sent to France for training, practically all of them waited at least three months before they could even begin their training; many of them waited six months, and a few of them waited a year. By November 11, 1918, only 907 officers had been graduated from observation schools in the United States and only 509 of them had been sent to France.⁵¹

⁴⁹"Schedule for the Production of Observers in the United States," Headquarters, American Expeditionary Forces, France, June 4, 1918, J, Hy AS AEF, Vol. 2, p. 29.

⁵⁰"Statistical Summary of Training, Observers," 1918, J, Hy AS AEF, Vol. 3, p. 7.

⁵¹"Observation Training, 1917-1918," 1918, A, Hy AS AEF, Vol. 16, p. 103.

CHAPTER VII

TRAINING FOR AERIAL OBSERVATION IN EUROPE

Organization

The Training Section of the Air Service, American Expeditionary Forces, was created on July 2, 1917.¹ The Training Section as it existed in the summer and fall of 1917 had been granted jurisdiction over both personnel and training although in fact its authority over the former was never exercised. On December 12, 1917, after Brigadier General Benjamin D. Foulois became Chief of the Air Service in the American Expeditionary Forces, a memorandum announced that:

all matters relating to training and organization of personnel in France, England, and Italy will be under the control and direction of the Training and Organization Section. This section will be responsible for the personnel of organized units requiring training, and for their pay, training, subsistence, and accommodations from the time they come under the jurisdiction of this section until they are transferred to another section.²

This gave the Chief of the Training Section even more authority and responsibility for training matters. The Training Section's assumption of administrative control of the training schools did not proceed smoothly. Subsequently it was decided that the Chief of Air Service

¹Special Order Number 2, Office of the Aviation Officer, American Expeditionary Forces, July 2, 1917.

²Memorandum, Office of the Chief of Air Service, American Expeditionary Forces, December 12, 1917, in J, Hy AS AEF, Vol. 1, p. 12.

alone would exercise control over the schools and that the Training Section would be regarded simply as a part of his staff. The Training Section was ordered to confine itself to supervising and coordinating training and was relieved of all conflicting duties. In April, 1918, however, the Training Section again assumed command over all aviation schools when the Chief of the Training Section was designated as the Director of Army Aeronautical Schools, the Chief of the Air Service being the Commandant.³

Flying Training

It was evident from the beginning that as much as possible of the enormous training program would have to be conducted in the United States. At first, however, only primary training could be given there because in the United States no airplanes and no qualified instructors were available for advanced training. Consequently, it was necessary to establish large schools and training centers in Europe for advanced and specialized training. Until this was accomplished, Allied schools had to be used to the fullest extent possible.

In the spring of 1917 there were no American officers in Europe qualified to take charge of the higher phases of aviation instruction such as pursuit, bombardment, observation, and aerial gunnery. The officers assigned to special instruction knew little or nothing about the subjects they were called upon to teach; therefore, they had to

³"History of the Training Section, Air Service, American Expeditionary Forces, France," 1918, J, Hy AS AEF, Vol. 1, pp. 6-10.

educate themselves with whatever means were at hand.

By the summer of 1917 it had become apparent that a sufficient number of aviators with even primary training could not be expected from the United States in time to meet the program that was contemplated, and that it would be necessary to call upon the Allied schools in Europe for primary as well as advanced training. The Allied Air Services assured the United States that it would be possible to give primary training to a large number of men, and General Pershing accordingly requested that 100 cadets a month be sent to Europe beginning in July, 1917.⁴ A number of eligible Americans in Europe who had served with either the French or British were examined and enlisted for flying training. In all, approximately 2,300 cadets, without primary flying training, were sent to Europe or enlisted in France.⁵

The primary training of these men did not proceed as had been planned. The Allied governments, which had offered to train the cadets, had expected them to arrive during the summer of 1917. Although a few cadets did arrive in August and September, the majority of them did not reach Europe until October, November, and December. By this time the weather was not favorable for training, the Italians had suffered a setback, the Germans had advanced, and the Allies had increased their own training programs and were using their own schools to full capacity--all of which combined to frustrate the plans for early primary training abroad. The American schools had not been completed, but the

⁴"Training of Cadets, AEF," 1918, A, Hy AS AEF, Vol. 16, p. 100.

⁵"Training in French Schools," 1918, A, Hy AS AEF, Vol. 16, pp. 101-102.

cadets, most of whom were honor graduates from early ground school classes in the United States, were first sent to Issoudun where an advanced flying school was being built. About a thousand of these cadets made up the "Million Dollar Guard" at Issoudun (so called because each cadet was paid \$100 a month). Enforced inaction and the fact that they were detailed to construction, cooking, guard duty, or whatever else needed to be done, caused low morale and great dissatisfaction among the cadets who were scattered among the aviation centers at Tours, Issoudun, St. Maxient, and the Paris headquarters. The only American school where primary instruction could be given was at Tours. Even there it was impossible to supply a sufficient quantity of training planes to take care of the cadets.⁶

Another unfortunate situation developed when cadets who had remained in the United States and completed their primary training were sent to Europe as commissioned officers. In many cases these men had entered the service later than the cadets who had been sent abroad and were still awaiting training. This situation was brought to the attention of Secretary of War Newton D. Baker on his inspection tour of the American Expeditionary Forces; Secretary Baker approved commissioning all cadets in Europe with the rank they would have been entitled to had they been commissioned at the date of their graduation from ground school.⁷ These commissions were temporary; that is, if the cadets holding them did not complete their flying training in

⁶"Training of Cadets, AEF," 1918, A, Hy AS AEF, Vol. 16, p. 102.

⁷Memorandum, Secretary of War to the Chief of Air Service, AEF, in A, Hy AS AEF, Vol. 15, pp. 212-215.

Europe, their commissions would lapse and they would revert to enlisted status. This plan went into effect during February and March, 1918, when all cadets in Europe were commissioned.

It was estimated that it would have taken eight to ten months to train all of the cadets at Tours had the school there been running at full capacity; therefore, a special board of investigation was appointed to consider how the training might be accelerated. On January 11, 1918, as a result of their report, all cadets not awaiting immediate entry into flying school or engaged in work for which they were especially qualified were sent to the center at St. Maxient.⁸ By April the number of cadets awaiting training had been reduced to 363 and by May to 160.⁹ Many of the cadets were assigned to French and Italian schools for training, or volunteered for training as observers or some other non-piloting position in the Air Service. Within the next few months the remainder of the waiting cadets were sent to schools in France and Italy.

The French gave as much assistance in training American Air Service personnel as the equipment of their schools and the exigencies of their own program permitted. In all, 444 students were graduated from primary training in French schools.¹⁰ These men received from 25

⁸Letter from Major Howard C. Davidson to Commander of Cadets, Tours, France, January 7, 1918, in "Training in French Schools," 1918, A, Hy AS AEF, Vol. 16, pp. 78-79.

⁹"History of the Training Section, Air Service, American Expeditionary Forces, France," 1918, J, Hy AS AEF, Vol. 1, p. 12.

¹⁰"Training in French Schools," 1918, A, Hy AS AEF, Vol. 16, p. 109.

to 30 hours of instruction on Farman and Caudron planes. Because of the age of these planes, this training was not the best, but it was better than nothing, and it materially lightened the burden of primary training in the American Expeditionary Forces.

By the autumn of 1917, it was realized that European school installations would be wholly inadequate to give full courses in advanced and specialized training to the number of pilots and observers required to meet the needs of the American Expeditionary Forces. If the number of men necessary for this program were to be passed through the schools in Europe, all that could be accomplished with the men and materials available would be to give them lecture courses and to provide them with superficial flying experience in planes other than the type of machines they would use in combat.

On November 23, 1917, the Air Service, American Expeditionary Forces, advised the War Department in Washington that the burden of complete training of all aviators sent abroad would have to be assumed by the training resources in the United States.¹¹ It was estimated that the advanced schools of the United States would begin to turn out fully trained pilots and observers during June and July, 1918. Cables received from the United States verified the estimate, but the output of trained personnel from the schools in the United States was greatly delayed, and the schools of the American Expeditionary Forces were required to bear a much larger portion of the training load than had been contemplated. In fact, only eight corps (observation) pilots

¹¹ Cable from Headquarters, AEF, France, to the War Department, Washington, November 23, 1917, in Department of the Army, United States Army in the World War, 1917-1919, III, 6-7.

completely trained in the United States reached the front before the cessation of hostilities.¹²

By the middle of July, 1918, the primary training of aviation cadets in Europe had been nearly completed. Primary training was continued only for deserving enlisted men who had volunteered for the Air Service with the idea of learning to fly and who had already applied for flying training. Each squadron in the American Expeditionary Forces was authorized to recommend one or two qualified enlisted men for flying training as a reward for the excellence of their service. The men selected in this manner made an excellent showing in the flying schools and later as pilots in units at the front.¹³

Training was carried on in such airplanes as could be spared by the French. These machines were not only antiquated and ill-adapted to the purpose, but they introduced into the schools a multiplicity of types which made the procurement of spare parts extremely difficult. At Issoudun alone more than 30 types of machines were in use,¹⁴ and large numbers of airplanes were forced out of service because of the impossibility of procuring the particular parts required.

In the fall of 1917, when it was decided to enlarge the

¹²Ralph E. DeCastro, "Notes on Observation Pilots," 1918, J, Hy AS AEF, Vol. 3, p. 356. Most American-trained pilots had never flown British or French combat-type machines until they reached France. It took several weeks to become used to flying these machines. It was late in the war before sufficient aircraft for complete flying training became available in the United States.

¹³"Training in French Schools," 1918, A, Hy AS AEF, Vol. 16, p. 103.

¹⁴"History of the Third Aviation Instruction Center, Issoudun, France," 1918, J, Hy AS AEF, Vol. 8, p. 43.

American schools in France, orders for airplanes were increased but the Training Section was never given any authority for obtaining supplies. Tools and equipment which were needed at the schools were kept in reserve for squadrons which did not materialize for possible demands at the front. To add to these difficulties, early in 1918 the War Department in Washington set up an embargo on Air Service personnel and matériel.¹⁵ It was necessary to increase the shipment of infantry and machine gun units to France to meet the enemy advance but there were not enough ships to take care of both the ground troops and the air personnel and matériel. The result of this embargo, which lasted until June, 1918, was an extreme shortage of personnel, both enlisted and commissioned, in all Air Service schools, none of which could operate near its capacity. Moreover, the needs for flying units for operation with troops in the front had to be met; consequently Air Service depots, assembly areas, and repair plants in the Services of Supply were stripped of experienced personnel to such an extent that the resultant loss in efficiency was not overcome in most instances for months and in some cases it was never overcome.¹⁶

¹⁵Memorandum, "Revision of Priority Schedule," Office of Chief of Staff, General Headquarters, AEF, April 9, 1918, Department of the Army, United States Army in the World War, 1917-1919, II, 293.

¹⁶During the spring of 1918, Britain and France pressed Gen. Pershing to increase American shipments with an exclusive priority on infantry and machine gun units. The American Commander-in-Chief, eager to get his forces organized on a self-sufficient basis, wanted artillery and service troops as well. Arguing with the same determination that he had maintained regarding the preservation of the identity and integrity of United States forces, Pershing finally secured Allied concessions permitting the transportation of some American artillery and service troops. Pershing's persistence was most distasteful to Allied leaders. Although America finally succeeded in building up a

Initially the prospective pilot was put through a course of primary training which entitled him to the reserve military aviator rating. Pilots trained by the French were given the French brevet, which was regarded as the equivalent of the reserve military aviator rating. The practice arose of permitting the foreign authorities to certify a student to the American Air Service for the reserve military aviator rating upon completion of the work required by their respective schedules.

In the beginning the airfield at Tours was a French school for primary flying training, but later it became the center of training for all aerial observers in the American Expeditionary Forces. The first class of 47 candidates arrived at Tours on August 15, 1917. The field at Tours was turned over to the Americans on November 15, 1917. During the intervening period the first class was succeeded by the second, third, and fourth classes, all recruited from Americans who enlisted in Paris for flying training.¹⁷

The output of trained pilots during the early period fell far short of the anticipated number of 100 graduates per month. The best previous record of the French, who had operated a school there, was 82 in a month. During the first four months of American supervision the average output per month was less than 40 pilots; but there were only 50 to 60 Caudron G-3 planes available and since it was impossible to obtain new machines, most of these had been extensively repaired. By

large force, it was too deficient in artillery to be a well-balanced offensive organization.

¹⁷"History of the Second Aviation Instruction Center, Tours, France," 1918, J, Hy AS AEF, Vol. 7, pp. 12-15.

the beginning of 1918 there was only a handful of planes left at Tours.¹⁸

In December the French were notified that by February 1, 1918, they might completely withdraw their personnel, which would be replaced by an American instruction and maintenance staff. Two additional flying fields were taken over and the training system was changed from French schedules to the American reserve military aviator type. On January 28, 1918, an additional flying field was taken over, making four fields in all; and about 30 new Caudron machines arrived.¹⁹ As a result the school was able to turn out more and better trained pilots to be sent to Issoudun for advanced training. During February, 45 pilots were turned out and in March the goal of 100 was exceeded by 4.²⁰ From then on the output of the schools was: April, 52; May, 95; June, 88; and August, 16. The decline of trained pilots was due to the lessening importance of primary training for Americans in France and the necessity for expansion of the observers' school. By the last week in August, 682 reserve military aviators had been turned out.

About the middle of January, 1918, an observers' school was begun at Tours. The planes available for observation work were Sopwith, Bréguets, and SIA's; the last were not used because they were considered unsafe, but their motors were installed in Bréguets. A great deal of construction was done and new fields were added for observation training. In September, 1918, when the school had already

¹⁸ Ibid., p. 17.

¹⁹ "Schools Established for the Air Service Training Program, 1917-1920," I, 76, in USAF HD Archives.

²⁰ "History of the Second Aviation Instruction Center, Tours, France," 1918, J, Hy AS AEF, Vol. 7, pp. 7-15.

become twice its original size, it was increased still further. By this time new machines, including Bréguets, Salmsons, and DH 4's, had arrived and greatly increased the efficiency of the school. In addition to the observers' school, an aerial gunner school, a radio school, and a photographic school were established at Tours early in 1918.²¹

One group of approximately 50 student observers was received from the United States in February, 1918. Regular arrivals began in August, 1918, and during August, September, and October 385 observers were received from the United States. This number was considerably below the schedule required to meet the observation program for the American Expeditionary Forces and strenuous efforts were made to make up the deficit in Europe. A large number of officers were detailed for observers' training, of whom 1,825 passed the physical examination. Of the total of 1,250 who began training in France, 390 failed to graduate, leaving a total of 860 who completed training December, 1918. The total number sent to the Zone of Advance for duty and assignment up to December, 1918, was 704.²²

The training of corps (observation) pilots was begun at Tours in the spring of 1919 but it was found advisable to transfer both the flying training of these pilots and their instruction in general principles of observation work to another field which was established at Issoudun. A system of rotation was organized whereby pilots so trained received some flying experience with observers at one of the

²¹Ibid., p. 16.

²²Harold Wilder, "History of Aerial Observation Training in the AEF," November 30, 1918, J, Hy AS AEF, Vol. 3, p. 4.

other observation training centers before their assignment to the front.

The course given to observers at Tours was intended to cover everything necessary to qualify the observer for front line duty except practical experience in the control of artillery fire, which was given by supplementary instruction at Châtillon, Souge, Coetquidan, and other artillery centers. Observers trained in the United States were given refresher courses and transition training on combat type machines at Tours.²³

Although the site for the flying field at Issoudun had been selected and approved in June, 1917, construction was not begun there until August. A lack of material and a shortage of personnel held up work on the field. Roads had not been built before rainy weather set in and the camp was a sea of mud. The flying field was newly sown and mud thrown from the wheels of planes broke propellers almost as fast as they could be put on. Cadet Edward V. Rickenbacker, who was a student in the first class at Issoudun and knew a great deal about automobiles, conceived the idea of mudguards for the planes. At first the idea seemed ridiculous, but a Nieuport equipped with mudguards worked so well that thereafter both French and Americans used them.²⁴

Although Issoudun was intended primarily for pursuit training, a number of corps pilots were trained at the school. After a thorough course in advanced flying, the students were carefully drilled in acrobatics and formation flying. After graduation from these courses,

²³W. W. Hoffman, "Observation Training," April 27, 1918, in USAF HD Archives.

²⁴"History of the Third Aviation Instruction Center, Issoudun, France," 1918, J, Hy AS AEF, Vol. 8, p. 13.

students were given a full course in aerial gunnery either at the French school at Cazaux or the American school at St. Jean-de-Monts. In all, 766 pilots were graduated from Issoudun with complete training including aerial gunnery. By the end of the war 627 of these men had been sent to the Zone of Advance,²⁵ while the remainder were retained as instructors, testers, and staff pilots.

It was impossible to secure in Europe the types of training machines desired and it was necessary to take any kind available. Consequently no less than 30 different types of airplanes were in use at various times at Issoudun, 17 types of Nieuports alone being constantly in service. This resulted in the supply department of the school having to carry about 44,000 separate airplane parts and 20,000 different engine parts.²⁶

In order to permit the expansion of the school, its activities had to be divided among outlying fields. The number of machines which could be used effectively without danger of collision on any given field, no matter how large, was limited. A considerable increase in flying could be accomplished only after additional fields had been established at a distance of two or three miles from the main field. Although separate installations were self contained and operated independently, they relied on the main field for supply and major airplane and engine repairs. At the date of the Armistice, ten separate fields were in operation in and around Issoudun.²⁷

²⁵ Patrick, Final Report, pp. 49-50.

²⁶ "History of the Third Aviation Instruction Center, Issoudun, France," 1918, J, Hy AS AEF, Vol. 8, p. 43.

²⁷ Patrick, Final Report, pp. 9-10.

The use of Avord, the largest French flying school, as a training center for American pilots was purely a means of accommodation for a surplus of untrained officers and cadets during the early training period of Air Service personnel in France. Advanced flying training was the main course offered there. Of the 163 students who started training at this school, 148 were graduated. Training was discontinued at Avord late in September, 1918.²⁸

When the United States entered the war the importance of aerial gunnery training was only beginning to be realized. The French government was reluctant to permit the firing of aerial machine guns except in districts where inhabitants were not likely to be injured. It was necessary, therefore, to build training schools either near a large body of water or in some very sparsely inhabited area, the latter being difficult to find in France. Even effective ground training in the technique of aerial gunnery was impossible due to the scarcity of machine guns and machine gun ammunition. Nevertheless, it was considered necessary to give a course in aerial gunnery to all flying personnel, pilots, observers, and gunners who were to be sent to the front.

A school with an area of 14,000 acres was located on the Lake of Cazaux. The water afforded excellent use of water targets and, since the neighboring region was heavily wooded and uninhabited, there was a large area available for shooting. On February 8, 1918, arrangements were completed with the French to train 30 pilots and 25

²⁸"History of the Fourth Aviation Instruction Center, Avord, France," 1918, J, Hy AS AEF, Vol. 6, p. 205.

observers for the American Air Service each month. Early in April, 30 American-owned Nieuport planes arrived at Cazaux, 30 more were delivered later, and toward the end of the instruction four Avion Renault tow-target planes were flown in. Cazaux was the central gunnery training station for American pilots and observer gunners from April until October, 1918, when the gunnery school at St. Jean-de-Monts opened. The French instructors at Cazaux trained 225 artillery observers, 118 bombardment observers, 495 pursuit pilots, and more than 200 anti-aircraft balloon company gunners. This was one of the most important contributions made by the French to American Air Service training.²⁹

Numerous sites for a second gunnery school, to be operated by the Air Service, were considered but none were found satisfactory until a place suitable for shooting over water was finally discovered on the west coast of France: the village of St. Jean-de-Monts, midway between St. Nazaire and La Rochelle. Although the site at St. Jean-de-Monts was decided on in February, 1918, it was not approved until the middle of May. Training began with 51 students on August 1, 1918. Aerial gunnery sections at Tours and Clermont-Ferrand relieved St. Jean-de-Monts of the responsibility of handling all observers; the plan was to concentrate pilot gunnery training at St. Jean-de-Monts. The courses ranged from three weeks for a complete aerial gunnery course to four to six days for refresher courses. The original plans called for the instruction of from 200 to 300 students each month, but since the school was still in its infancy when the Armistice was signed there were only

²⁹Patrick, Final Report, p. 47.

266 graduates: 54 pursuit pilots, 157 corps (observation) pilots, 20 artillery observers, and 35 pursuit observers.³⁰

The training of artillery aerial observers in the American Expeditionary Forces began in the fall of 1917, following the arrival in France of the first artillery brigades. Officers were detailed from these brigades, sometimes against their wishes, and given training as aerial observers. The first aerial work was given at Le Valdahon with French instructors, flying personnel, and equipment. The primary training given at the brigade centers was supplemented by instruction at the I Corps School at Amanty and by the assignment of the observation personnel to French squadrons for a period of actual field training. At least 50 observers a month could have been trained in this manner, but the number of observers arriving in the Zone of Advance became insufficient to keep the Air Service squadrons up to strength and the training had to be discontinued.³¹

The artillery at this time detailed only a few officers for training in observation by the Air Service; it was deemed necessary for most officers to remain with their units during their artillery training period in order to become familiar with French artillery practices. This arrangement did not prove satisfactory as it provided only a limited number of observers who were specialists in aerial observation in conjunction with the artillery. To meet the requirements

³⁰"American Aerial Gunnery School, St. Jean-de-Monts, France," 1918, J, Hy AS AEF, Vol. 10, p. 78.

³¹"Training Artillery Observers," 1918, J, Hy AS AEF, Vol. 3, p. 7.

of the other services, it was apparent that a more comprehensive course in observation must be given, largely by the Air Service. Consequently, the Air Service decided to organize a central training school for the primary phase of aerial observation training, and various advanced schools located adjacent to artillery training centers where aviation units could be utilized under simulated combat conditions.³²

Tours was chosen as the location for the central training school and in September it was designated the Air Service Observers' School. Construction was started for a student unit of 200, and it was planned to begin operations in December, 1917. Because of the failure of construction material to arrive and the overcrowding of the flying school by cadets who arrived in larger numbers than was anticipated, the first class of observers did not begin until mid-January, 1918.³³

At the end of 1917, officers from the artillery, infantry, and other services were detailed by their respective organizations for training in observation by the Air Service, and sent to the observation school at Tours. The system of training was patterned after the French method and certain features of British training were instituted. The fact that the American artillery employed French tactics was the dominant factor in the course of instruction.

During the first five months of training--January to June, 1918--the lack of equipment, both flying and construction, was the most

³²Harold Wilder, "History of Aerial Observation Training in the AEF," November 30, 1918, J, Hy AS AEF, Vol. 3, p. 3.

³³"Observation Training," 1917-1918, A, Hy AS AEF, Vol. 16, pp. 113-114.

serious handicap to the growth of this training program. During the second half of 1918 the fact that sufficient and suitable personnel were not received from America or from line organizations in the American Expeditionary Forces kept the number of observers trained below the capacity of the schools.³⁴

Coetquidan, formerly a French artillery school, was taken over by the Americans in the fall of 1917 and was enlarged to become the 1st Artillery Aerial Observation School. Work was started on the field by the French in September, 1917, and it was turned over to the Air Service on January 1, 1918. Ten days later, five American pilots and five Farman F-41 airplanes arrived. Inclement weather and shortages of suitable training aircraft contributed to the delay in the flying phase of training, and graduations did not take place until June, 1918.³⁵

Construction of the 2d Artillery Aerial Observation School was begun in December, 1917, by the French at Souge, formerly one of the principal French aviation fields. The airfield was lengthened and a drainage system installed, and the observation course began in April, 1918. Souge, like Coetquidan and the other observation centers, was a sort of overflow camp for the aerial observers' schools. Training at Souge was somewhat hampered by the lack of serviceable machines. The Sopwith planes, with which instruction began, were replaced by 10 Curtiss aircraft bought from the British instead of by new aircraft.

³⁴Harold Wilder, "History of Aerial Observation Training in the AEF," November 30, 1918, J, Hy AS AEF, Vol. 3, p. 3.

³⁵"History of the First Artillery Aerial Observation School, Coetquidan, France," 1918, J, Hy AS AEF, Vol. 10, p. 146.

These planes were underpowered and slow but could be used for artillery réglages (adjusting artillery fire).³⁶

Observers, mainly artillery officers detailed for this duty, were trained at the 3d Artillery Aerial Observation School at Mailly during the winter of 1917-1918 without any formal record being sent to the Training Section at American Expeditionary Forces headquarters. The candidates, selected from the artillery brigades stationed there, were trained by a French observation squadron. It had been planned to continue primary observation training at Mailly in the same way it was done at Coetquidan. This intention was altered to comply with the Training Section's attitude, which described the method of conducting this school as a "matter of temporary expedience" and "not a normal procedure."³⁷ Plans were drafted to provide for the location of American Air Service units at Mailly to cooperate with the artillery in réglage practice and to give advanced training to observers in long-distance artillery work and reconnaissance. An aviation detachment consisting of 3 officers and 149 men was on duty there in April, but because Mailly was evacuated during the German advance in the spring of 1918, the new training project never reached completion.³⁸

The 4th Artillery Aerial Observation School at Meuse, which

³⁶"History of the Second Artillery Aerial Observation School, Souge, France," 1918, J, Hy AS AEF, Vol. 10, p. 170.

³⁷"History of the Training Section Air Service, AEF, France," 1918, J, Hy AS AEF, Vol. 1, p. 79.

³⁸"History of the Third Artillery Aerial Observation School, Mailly, France," 1918, J, Hy AS AEF, Vol. 10, p. 213.

trained observers in cooperation with the field artillery, began as an annex to the artillery school at Coetquidan. Actually, Meucon was used only to a small extent for training observers. There was an Air Service detachment there but it only assisted artillery officers in getting experience in firing with observers. No observation students arrived until mid-July, 1918, when four observers reported from Tours. During September there were only three students under training. The schools at Meucon and Coetquidan were separated on September 16, 1918, and Meucon became a finishing school for observers as well as an artillery training center. During October, ten observers finished the course despite the fact that the weather was not suitable for flying. By November four more observers were undergoing flying instruction.³⁹

In contrast to Meucon, the story of the 5th Artillery Aerial Observation School at Le Valdahon was largely one of idleness. Although a field artillery unit was on duty there from May through the summer of 1918, not a single Air Service officer was sent there for observation training. The school was located about a mile from the camp where some of the first American observers trained in France. This instruction had been started in August, 1917, in cooperation with a French observation squadron which was then on duty at the station, and was discontinued on February 15, 1918, when the French squadron left. It was intended to continue instruction in the same manner as before, but the plan was altered to provide for advanced training in conjunction with artillery units to be given only to observers who had completed their primary

³⁹"History of the Fourth Aerial Observation School, Meucon, France," 1918, J, Hy AS AEF, Vol. 10, p. 217.

flying training. During the summer of 1918 the school was used solely for instruction of artillery officers. In October a class of ten student observers arrived from Tours for advanced training but only two classes were graduated before the Armistice was signed.⁴⁰

The Artillery Officer School at Saumur, which was a technical school for the training of artillery specialists, served in the capacity of a training school for a small number of observation students who did not have sufficient knowledge of artillery methods to pursue the aerial course. An Air Service unit was established there in April, 1918. Although equipment for the school had been requisitioned the preceding November, only two Farman planes were available when the school opened; these planes were augmented by six others during the summer. Two classes of Air Service personnel were trained at Saumur during May and June, 1918. Subsequent classes were made up of students drawn from the field artillery school, and from 80 to 100 artillery officers a month were trained for observation duty in the Air Service. In the fall of 1918, the course was opened to all officers possessing the necessary technical background who volunteered to become artillery observers.⁴¹

The I Corps Aeronautical School came into being to provide activity for nearly 500 American cadets waiting at St. Maxient for flying training. The cadets volunteered for machine gun training at

⁴⁰"History of the Fifth Artillery Aerial Observation School, Le Valdahon, France," 1918, J, Hy AS AEF, Vol. 10, p. 241.

⁴¹"History of the Aviation Department, Saumer Artillery School, France," 1918, J, Hy AS AEF, Vol. 10, p. 252.

Gondrecourt, and although no facilities existed for giving training in aerial gunnery, a two-week course was set up which gave the men a basic knowledge of machine gun techniques. The training was supposed to be a preface to class work for observers; 225 cadets in classes of 50 to 70 students attended this school in March and April, 1918.⁴²

The II Corps Aeronautical School at Châtillon-sur-Seine was authorized on February 8, 1918, to provide for the training of aerial observers. Work was begun on the flying field in February. Arrangements for artillery cooperation with the II Corps Artillery School at Montigny-sur-Aube were made. By midsummer the demand for thoroughly trained observers at the front was so acute that extensive enlargements were necessary. The augmentation of training facilities began to bear fruit in September when 53 observers were graduated. A total of 188 observers went from this school to the front.⁴³

The American Replacement Concentration Barracks at St. Maxient was opened in December, 1917. During the first months of 1918, the station was used principally as an overflow camp and was of little importance as a training center. In June, 1918, it became a depot for the classification of enlisted personnel, an area for the reorganization of squadrons, as well as the site for four important schools for commissioned officers. It became the policy of the Air Service to send all officers and squadrons to St. Maxient immediately after their

⁴²"History of the I Corps Aeronautical School, Gondrecourt, France," 1918, J, Hy AS AEF, Vol. 10, p. 261.

⁴³"History of the II Corps Aeronautical School, Châtillon-sur-Seine, France," 1918, J, Hy AS AEF, Vol. 10, p. 264.

arrival in France.

Adjutants' school, supply officers' school, engineer officers' school, and flying officers' school were established at St. Maxient.⁴⁴ The first two schools were designed to outline the general regulations and office procedures in the American Expeditionary Forces and to further the instruction received in ground school in the United States. The engineering course sought to familiarize officers with the motors and planes used at the front. The school for flying officers consisted of a complete course in advanced ground training. This consolidated and superseded the work that had previously been given at the various training centers in France by concentrating all ground work at St. Maxient. By the end of the war, 4,195 commissioned officers and 22,961 enlisted men had passed through St. Maxient; 1,973 officers had been enrolled in the flying schools, and 383 had been trained as ground officers.⁴⁵

Flying training in British schools was of three varieties: the training of cadets who had no previous flying training; the training of officers who had received primary training in the schools in the United States and Canada; and the training of officers who had received primary training in the American Expeditionary Forces. The last group included selected officers sent from France for specialized instruction in higher phases of training. A total of 542 men received flying training in England. Of these, 204 cadets were completely trained; 176 officers,

⁴⁴"History of the Air Service Replacement Concentration Barracks, St. Maxient, France," 1918, L, Hy AS AEF, Vol. 2, pp. 7-8.

⁴⁵Ibid., pp. 6-11.

partly trained at the schools in Canada and the United States, received the rest of their training in England; and 162 officers from the American Expeditionary Forces schools received some training. The total of 542 included 6 observers and 83 officers who were returned to stations in France where they were used as instructors. In all, 216 pilots were sent to the front, where they operated either with the British or in the American squadrons. (The 17th and 148th squadrons were completely trained and equipped by the Royal Air Force.)⁴⁶

Plans were made to conduct night flying training in England; during the spring and summer of 1918 approximately 20 pilots and 6 observers were selected for training as instructors and sent through British schools and then to the British front for further experience. These were the only officers fully trained in England in night operations. In the latter part of September, 1918, an American school for night operations was opened near Chester, England, but delays in receiving equipment prevented any effective instruction being given up to the cessation of hostilities when the center was evacuated and personnel returned to the United States.⁴⁷

The assistance given by the Royal Air Force to the Training Section of the Air Service was invaluable. While the contribution of completely trained pilots delivered to the American Expeditionary Forces was small, the value of training given to instructors in methods of teaching day and night flying, observation, gunnery, and navigation

⁴⁶G. M. P. Murphy, "Recapitulation of United States Air Service Work in Great Britain and Ireland," 1918, A, Hy AS AEF, Vol. 16, pp. 42-43

⁴⁷Patrick, Final Report, p. 50.

was substantial.⁴⁸

During the summer of 1917, arrangements were made with the Italian government for the training of American Air Service personnel in Italy. The first students, a detachment of 46 cadets from the 1st Aero Squadron in France, arrived at Foggia, Italy, on September 26, 1917. About the middle of October, 1917, the second detachment of American cadets arrived under the command of Captain Fiorello H. La Guardia, a New York Congressman of Italian extraction who had been active in military preparedness before the United States entered the war. In a letter written immediately after his arrival at Foggia, Captain La Guardia stated: "Facilities for training are excellent, and there is no reason in the world why we cannot turn out men as quickly and efficiently as the most exacting and fastidious legislator would demand."⁴⁹ The optimism of La Guardia's judgment was not rewarded with a rich harvest of trained fliers. Although the original agreement contemplated the speedy training of 500 American students, the sum total of students graduated up to November 11, 1918, was only 406, and much difficulty was experienced in getting this number through.⁵⁰ Although the living quarters were excellent, conditions were not pleasant, for there were almost no sanitary facilities and the valley was a breeding place for mosquitoes. In the summer and fall it was so

⁴⁸ G. M. P. Murphy, "Recapitulation of United States Air Service Work in Great Britain and Ireland," 1918, A, Hy AS AEF, Vol. 16, pp. 50-55.

⁴⁹ As quoted in Arthur Mann, La Guardia, A Fighter Against His Times (New York: J. B. Lippincott Co., 1959), I, 84.

⁵⁰ "Training in Italy," B, Hy AS AEF, Vol. 1, p. 14.

hot that flying had to be suspended in the afternoon.

La Guardia was appointed American representative of the Joint Army and Navy Aircraft Board in Italy in February, 1918, and he took charge of all contracts with the Italians. Relations with the Italian government were excellent, but a great deal of difficulty and delay was experienced in securing Caproni aircraft. Causes of these delays and difficulties included insufficient raw materials in Italy; inadequate docking facilities, which delayed matériel sent directly to Italy; and imperfections in the construction of the planes, which had to undergo several modifications until they were finally satisfactory. La Guardia and his assistant, the celebrated violinist First Lieutenant Albert Spalding, went to Spain in May and obtained steel there for use in aircraft production. In addition to these difficulties, the delay in production was aggravated by the bidding of the Army and Navy against each other for planes.⁵¹

Advanced training began as early as November, 1917, but there were only three suitable planes at the school and the course did not take shape until February, 1918, when Italian pilots arrived. A few of the American fliers were turned out under this training and were immediately assigned as instructors. The course was expanded but the scarcity of planes was an important factor in training until the spring of 1918 when the delivery of advanced Caproni aircraft began. Students at Foggia initiated the practice of flying in windy weather, a procedure which heretofore had not been regarded as feasible for

⁵¹Albert Spalding, Rise to Follow, An Autobiography (New York: H. Holt and Co., 1943), pp. 233-244.

training purposes. There was a large barren area surrounding the field, making it possible to land almost anywhere. There was never sufficient Italian personnel to handle the needs of the school. From the beginning the American students were required to maintain and repair the machines they were flying. American authorities were promised equipment and mechanics time and again, but the Italians failed to fulfill their contracts.⁵² During the summer of 1918 some instruction was given in night flying on the 450 horsepower Caproni. Some advanced flying was done with the SIA airplanes but this machine had a tendency toward nose-heaviness and required an expert pilot for its fast landings. After several bad crack-ups, training with the SIA's was discontinued.⁵³

When the Italian-trained graduates were sent to France for advanced training it was discovered that the planes used in Italy differed so much from planes used in France that the training had to be done all over again. It appears that the flying school in Italy was kept on there more for political reasons than out of necessity.

The Royal Italian Gunnery School on the seacoast at Fubara, about 42 miles from Rome, was used by a few American aviators for gunnery training and instruction in acrobatics for fliers. The course was not considered adequate until a number of changes and amplifications were made. American pilots began work in aerial gunnery training there

⁵²"History of the Eighth Aviation Instruction Center, Foggia, Italy," 1918, J, Hy AS AEF, Vol. 7, pp. 262-266.

⁵³Ibid., p. 267.

in April, 1918. In August the site was abandoned as an American training center because it was too far from other American training activities and because the aerial gunnery school at St. Jean-de-Monts had been completed.⁵⁴

On June 15, 1918, the first detachment of American aviators trained completely in Italy left for the Italian front. When the detachment arrived in Rome, Captain La Guardia took command, going on to the front with them. From then until the cessation of hostilities, other detachments were sent when they were ready. All training activities in Italy ceased on November 11, 1918, and within a week the last detachment of flying students left for St. Maxient, France.⁵⁵

Mechanics Training

The Air Service originally proposed to train its mechanics in French training centers. As early as July, 1917, opportunities for training a number of American mechanics in the French flying schools at Pau, Avord, and Chartres had been discovered, but personnel did not arrive in the anticipated volumes. Although mechanics were trained in these schools almost as fast as they arrived, only a few hundred were trained in this manner. From October, 1917, to January, 1918, seven factories in the neighborhood of Paris were utilized in training

⁵⁴"History of the Royal Italian Aerial Gunnery School, Fubara, Italy," 1918, J, Hy AS AEF, Vol. 10, p. 376.

⁵⁵Joseph M. Armeé, "History of the Combat Division of the Air Service, in Italy," 1918, B, Hy AS AEF, Vol. 1, pp. 70-78.

mechanics.⁵⁶

One of the first agreements which the American Expeditionary Forces entered into with the French government was for the loan of 12,000 American mechanics. Early in the war France had suffered heavy losses in the ranks of her skilled mechanics then fighting with the combat forces and in 1917 she requested American assistance in meeting her needs.⁵⁷ In November, 1917, 15,000 skilled mechanics were organized into four regiments at Kelly Field, Texas. The first mechanics regiment, commanded by Lieutenant Colonel Henry Joy, a former president of the Packard Motor Company, arrived in France on February 25, 1918. Fourteen companies of this regiment were assigned to the French and the remaining six companies were assigned to the American Expeditionary Forces Motor Transport Corps, which was badly in need of mechanics. The second regiment, which arrived in France in March, 1918, assigned fourteen companies to the French and to the American Expeditionary Forces Railway Transportation Service, the other six companies being assigned to the Air Service. Both the third regiment, which arrived in France in July, and the fourth, which arrived there in August, 1918, were finally assigned to the Air Service.⁵⁸ Evidently the French were not as greatly in need of motor mechanics as had been thought; a

⁵⁶"History of the Training Section, Air Service, AEF, France," 1918, J, Hy AS AEF, Vol. 1, p. 13.

⁵⁷Memorandum from General Pétain, Commander-in-Chief of the Armies of the North and Northeast, to General Pershing, Commander-in-Chief of the AEF in France, December 29, 1917, in Department of the Army, United States Army in the World War, 1917-1919, II, 127-130.

⁵⁸"History of the Mechanics Regiments," 1918, H, Hy AS AEF, Vol. 1, pp. 7-26.

number of trained mechanics assigned to them were used for construction work, others were used as chauffeurs, and two were drowned while working in a French laundry. Only a few were actually used for the mechanical work for which they were trained.⁵⁹

On September 7, 1917, the Air Service and the managers of several airplane factories in the vicinity of Paris entered into an agreement which called for placing a small number of men in the Bleriot, Bréguet, and Nieuport factories for a course of from two to three weeks. As it turned out, a total of seven factories near Paris were used instead of the three originally contemplated; the four additional factories were the Brasier, Hispano-Suiza, Renault, and Gnôme. Seven mechanics companies were trained in the factories near Paris. American civilian experts, who had accompanied the Bolling Mission to Europe, proved invaluable as instructors. The courses of training lasted from four to six weeks, and as soon as one group was finished it was sent out to one of the schools and its place filled by another group. In February, 1918, this system of training was discontinued because sufficient men had been graduated.⁶⁰

Mechanics were sent also to Pau for a period of from five to seven weeks for instruction in September, 1917. Officers and men were

⁵⁹ Ibid., pp. 42-46. General Foulois tried to get these men for the Air Service, but on May 16, 1918, he was informed that the United States had promised to send 60,000 skilled workmen to the French, and these mechanics were being sent to them as partial fulfillment of that promise. Benjamin D. Foulois, "The Air Service, American Expeditionary Forces, 1917-1918," 1924, p. 24, in Foulois Collection, USAF HD Archives.

⁶⁰ "History of the First Aviation Instruction Center, Paris, France," 1918, J, Hy AS AEF, Vol. 7, p. 205.

instructed by the French. It was decided not to build a training camp at Pau because of supply difficulties. Instruction of mechanics was concluded there when the remaining men were ordered to report to Cazaux early in February, 1918.⁶¹

A group of mechanics sent to Bron arrived there about the middle of September, 1917. There were not enough motors available for instruction, living conditions were poor, and there was difficulty in securing instructors who spoke English and knew their subjects. About 100 students were ordered away before they had finished the course. Consequently, it was decided not to try to train mechanics at a French-operated school but to send them to the American school at Tours. This plan did not materialize because in December, 1917, the United States-Great Britain agreement to train 15,000 mechanics was consummated; thereafter, practically all mechanics training was accomplished in England.⁶²

Some American mechanics were sent to Italy for training as early as August, 1917; 74 motor mechanics arrived in Milan for instruction in the maintenance of Caproni planes, 25 others were sent to the Fiat factory at Turin. On October 15 the mechanics detachment left Turin to train at the Isotta-Franchini plant at Milan. By November all of the mechanics in Italy were withdrawn and sent to Romoranti, France, for training.⁶³

⁶¹"History of the Sixth Aviation Instruction Center, Pau, France," 1918, J, Hy AS AEF, Vol. 10, p. 11.

⁶²"History of the Fifth Aviation Instruction Center, Bron, France," 1918, J, Hy AS AEF, Vol. 10, p. 5.

⁶³Joseph M. Arme, "History of the Milan Headquarters," 1918, B, Hy AS AEF, Vol. 1, pp. 7-11.

On December 5, 1917, an agreement which contemplated the training of 15,000 American mechanics in British shops within six months was signed by Lord Rothermere for Great Britain and General Pershing for the American Expeditionary Forces.⁶⁴ The American trainees were to replace British personnel needed at the front. In effect, this agreement resulted in a grave shortage of maintenance and repair men for Air Service units in France, since mechanics destined originally for France were diverted to Great Britain and the number actually in France when the agreement was signed was insufficient to meet the needs of the American Air Service. The plan, however, relieved the American Expeditionary Forces of the burden of training most of the 30 mechanics squadrons a month called for at that time by overseas shipment schedules.

At the same time, the United States agreed to furnish the British 6,200 labor and construction troops. By September 1, 1918, 5,884 men had been sent to England, but during the month nine companies were withdrawn and transferred to the Air Service units in France, leaving only 3,653 troops at work on labor and construction on October 1, 1918.⁶⁵

During the twelve months that this training program with the British was in existence, over 70 separate Air Service training stations were operated in England. By June, 1918, there were over 100 squadrons

⁶⁴Memorandum, Headquarters, AEF, Paris, December 5, 1917, Department of the Army, United States Army in the World War, 1917-1919, III, 5-6.

⁶⁵"List of Detachments Sent to Great Britain," 1918, B, Hy AS AEF, Vol. 5, p. 29.

totalling 16,732 men undergoing training in England, and the United States was able for the first time to maintain the 15,000 mechanics promised. Nearly 50 of these squadrons were sent to France in July, August, and September.⁶⁶

Radio and Photographic Training

It was found that radio operators from the United States were insufficiently trained and a school was opened at Tours in January, 1918. The school at Tours graduated 37 Air Service radio officers and 161 radio mechanics and operators during the spring of 1918.⁶⁷ Three branches of the service were involved in Air Service radio work: the Air Service aero squadron commander was responsible for his observers, who operated the radios on the planes, and for the radio detachment of his squadron, who maintained the sets; the Signal Corps radio officer was charged with the supervision of ground artillery stations; and the artillery commanders supervised radio officers and operators of their own batteries and other units. This division of responsibility did not make for efficiency and there were many cases of failure in liaison between artillery and airplanes dispatched to conduct fire-control missions. In September the Signal Corps took over control of all radio operations, training, and supply, relieving the other two

⁶⁶ "Training with the RAF in the British Isles," 1918, B, Hy AS AEF, Vol. 5, pp. 4-12.

⁶⁷ Report of the Chief Signal Officer in War Department, Annual Reports, 1919, I, 1192.

services of all responsibility of this type up to the end of the war.⁶⁸

The photographic sections were well trained in the United States but they did not begin to arrive in France until late in the war. In the meantime, since there were no American instructors available in the American Expeditionary Forces, the training of pilots and observers in photography at Air Service installations was usually entrusted to the French. It was not until shortly before the close of hostilities that the United States Air Service could send its own photographic instructors to the more important training centers.⁶⁹

Balloon Training

Balloon observers and maneuvering officers could not have received a full course of instruction in the United States without seriously delaying the arrival of balloon units overseas. Balloon training in the American Expeditionary Forces started at Cupperly in the fall of 1917. The enemy advance into northern France in March, 1918, necessitated a hasty retreat from Cupperly to Camp Souge. It was also necessary to establish a balloon school in France for the instruction of observers detailed from the artillery and other branches of the service, as well as for the instruction of enlisted men seeking commissions in the balloon service. Twenty per cent of the observers taking the course and twelve per cent of the maneuvering officers

⁶⁸General Order Number 153, General Headquarters, AEF, France, September 10, 1918.

⁶⁹"History of the Photography Section," 1918, G, Hy AS AEF, Vol. 1, pp. 7-9.

failed to qualify but a total of 199 officers were graduated and 623 enlisted specialists were trained.⁷⁰

Balloon units were trained in the regulation of artillery fire as soon as they arrived in France. Each company was sent to an artillery firing center where it remained until relieved by a newly arrived company from the United States. Then it was assigned to a quiet sector on the front for battle training.⁷¹

In England, balloon observers were given some training in archaic spherical free balloons to give them confidence and to teach them what to do if they went adrift. Along the front the prevailing winds blew toward the German lines. When a balloon broke loose and was blown toward enemy positions, the observer was expected to get out at once; but if it drifted the other way, toward his own lines, he was expected to bring it down safely.⁷²

Conclusion

By September, 1918, pilots and observers were arriving in France in quantity for the first time. It was found, however, that they were not sufficiently trained to perform aerial exercises at the American Expeditionary Forces advanced schools. Observation pilots had

⁷⁰Charles Chandler, "Report of the Balloon Section," 1918, I, 2, in USAF HD Archives.

⁷¹Charles Chandler, "Report of the Balloon Schools," 1918, II, 8-25, in USAF HD Archives.

⁷²Charles Chandler, "Complete File of Balloon Notes, AEF," 1918, IV, 137, in USAF HD Archives.

been taught by obsolete methods and had not been given enough cross-country flying or training with infantry and artillery units. Training in the use of the compass, in formation flying, and in aerial gunnery had been inadequate in the United States. These deficiencies, together with the two-month period of inactivity while being shipped overseas, made it necessary to give fliers more training after they arrived in Europe. One of the chief difficulties arose in changing from training planes to combat-type machines (it was not until late in the war that DH 4's in any quantity were available at the flying schools in the United States). Sometimes the transition training took longer than learning to fly originally. By the end of the war, however, a great many of these defects in training had been corrected.

Morale was discovered to be one of the most important elements in the success of the flying schools. To keep morale at its best, it was necessary to select willing and able instructors of the highest caliber, and to eliminate undesirable students promptly, and to avoid all possible delays in training. It was also necessary to keep the flying schools and fields well equipped and up to date. The variety of planes was reduced to a minimum in order to limit the amount of supplies and spare parts. The mechanics and engineering officers had to be thoroughly trained to supervise properly the care of aircraft. Training had to be divided among outlying fields to prevent duplication of high-priced machinery.⁷³

Of the total of 218 pilots and observers killed in training

⁷³F. W. Zinn, "Criticism of Observer Training," A, Hy AS AEF, Vol. 15, p. 144; "Observations of Individuals on AEF Flying Schools," 1918, A, Hy AS AEF, Vol. 15, pp. 217-233.

centers in the American Expeditionary Forces, 169 were students undergoing instruction and 49 were instructors, testers, and ferry pilots. Of these accidents, 19 deaths were due to collision in the air, and of the rest, a great many were attributed to engine or pilot failure. In the schools of the American Expeditionary Forces the hours flown per fatality varied from 2,738 for primary training to 1,023 for advanced and pursuit training. The proportion of fatalities to graduation in the American Expeditionary Forces showed one fatality to 90 graduates in primary training, one fatality to 50 graduates in observation training.⁷⁴

By the cessation of hostilities, 1,674 fully trained pilots and 851 observers had been graduated from the schools in the American Expeditionary Forces. Of the personnel graduated, 1,402 pilots and 704 observers were sent to the Zone of Advance before the close of hostilities; the remainder were on duty as instructors, testers, and ferry pilots. When the war ended, however, there were only 744 pilots and 480 observers actually serving on the front in the squadrons operating there. The other pilots and observers were in transit to their next assignment.⁷⁵

During World War I the United States Air Service sent 46,667 enlisted men overseas. The first to go were sent to France to build training fields, assembly depots, and airdromes near the front. Others

⁷⁴"Training: Casualties, Accomplishments, Miscellaneous Remarks," 1918, A, Hy AS AEF, Vol. 16, pp. 119-124.

⁷⁵"Statistics on Training Observation Pilots," 1918, J, Hy AS AEF, Vol. 3, p. 8; "Observers Produced from AEF Observation Schools," 1918, J, Hy AS AEF, Vol. 7, p. 24.

were formed into squadrons in England and France to be ready as soon as American pilots were trained and sent to their organizations. Still others went to relieve French skilled labor of unskilled work so that the French mechanics could go back to the airplane factories.⁷⁶

On May 27, 1917, hardly six weeks after the United States entered the war, the first cadets sailed for France for training in the highly developed French flying schools. By the end of 1917, nearly 2,500 men were under instruction in France, England, and Italy. Unfortunately, the collapse of Russia, Italy's serious defeat late in 1917, and the weight thrown on France during the last great German offensive in the spring of 1918 made it impossible for the Allies to meet the schedule of training planes. Consequently, many of these cadets, the most promising of America's manpower potential, were idle for months. Nevertheless, what facilities were available greatly advanced the Air Service's preparation and helped to relieve the shortage of training equipment in the United States.

The chief obstacle to the training of observers had been initially the lack of installations and equipment. By June, 1918, however, it became apparent that not enough observers were arriving from the United States, and that those who were getting to Europe were not sufficiently trained to perform aerial work at the advanced schools in France. Of 725 observers requested for June and July only 145 arrived in August, 86 in September, and 149 in October (380 in all) who could be used on the front before the cessation of hostilities.

⁷⁶"History of the Training Section, Air Service, AEF, France," 1918, J, Hy AS AEF, Vol. 1, pp. 79-83.

In order to meet the deficiency during the fall of 1918, a large number of artillery officers were detailed to observer schools; about 825 of them passed the flying examination and began training. A total of about 1,250 observers started training in France; of these 390 failed to graduate. This large percentage of failures resulted from two factors: the high standards, and the unwillingness of some of the artillery officers to serve as observers. For a long time the status of these officers was unsatisfactory as to pay and promotions, but by August, 1918, they could either be commissioned in the Air Service, or when replacements were available, be returned to their own branch of the service. The total number of observers sent to the Zone of Advance in World War I was 704.⁷⁷

⁷⁷"Observers Produced from AEF Observation Schools," 1918, J, Hy AS AEF, Vol. 7, p. 24.

PART IV

AMERICAN AIR SERVICE OPERATIONS

CHAPTER VIII

THE TOUL SECTOR OPERATIONS

Introduction

During the summer of 1917, the area in Lorraine east of Verdun was selected by the Allied commanders as the place where American forces would concentrate and eventually fight. With British troops deployed to cover the channel ports and the French armies committed to the protection of Paris, the transportation systems in these regions were heavily burdened. The necessity for the supply and movement of additional forces made it essential for the Americans to occupy a less-crowded area where roads and railways were relatively free. The fact that there were few troops in Lorraine and that rail facilities, although extending across the entire width of France, were available for transporting men and supplies from the French ports south of Le Havre to the Lorraine Sector, were important considerations in the selection of this area as the American front.

Another factor which influenced this decision was General John J. Pershing's determination to place his forces where they would decisively affect the outcome of the war. The coal and iron mines near Metz, the fortress itself, and the railway systems at Sedan and to the southeast, all made the area protected by the Lorraine front of vital importance to Germany. Of the territory within striking distance of

the western front, this was the area the enemy could least afford to lose, because Germany's ability to maintain her armies west of the Rhine River depended upon her retention of this communications link. The American Expeditionary Forces in Lorraine would, therefore, be admirably located to strike at the most important German area near the battle front.

[The American Air Service began combat operations at the front in the spring of 1918. The Toul Sector was selected as the place where American squadrons would be stationed to get experience that would bridge the gap between the training schools and actual war conditions.) In this comparatively quiet locality, opposing armies were facing each other in well-defined positions which had been established early in the war. Both sides were using it as a rest area for tired troops or as a position to be held by units which had not been thoroughly trained. In spite of the fact that these conditions gave the poorly prepared United States troops a false idea of the realities of war, the American Air Service decided to use the Toul Sector.¹ Fortunately, the area remained inactive until the St. Mihiel offensive in September, 1918.

Corps Observation

[The 1st, 12th, and 88th Aero Squadrons made up the I Corps

¹Memorandum for the Chief of Staff (G-3), American Expeditionary Forces, from Benjamin D. Foulois, May 21, 1918, and letter to Benjamin D. Foulois from Maj. Armengaud, Chief of the Aeronautical Section of the French Mission, May 22, 1918, in Department of the Army, United States Army in the World War, 1917-1919, III, 299-301.

Observation Group, which, early in April, 1918, began active operations over that portion of the front known as the Toul Sector.² [The Group's airdrome was situated at Ourches about 18 miles behind the front lines.] The installation and equipment of the airdrome was practically complete by the time the Group was formed. Hangar and barrack space was ample and operations were not limited by faulty or incomplete installations.

The pilots, with but one or two exceptions, had never flown in combat. The Group and Squadron commanders were experienced in training work but none of them had flown more than one or two missions under war conditions. Most of the observers, after a course of intensive tactical and technical training in observation schools, had spent from one to two months on active duty as fliers with French squadrons at the front. These officers brought to their organizations valuable practical knowledge of the work about to be undertaken. The enlisted men, well trained in their specialties, proved qualified for the work at hand.³

The 1st Aero Squadron's planes were two-seated Spads⁴ equipped with 235 horsepower Hispano-Suiza motors; those of the 12th Squadron were bi-place 190 horsepower Avion Renaults; and the 88th flew British-built planes of the two-seater Sopwith type.⁵

²General Order Number 65, General Headquarters, American Expeditionary Forces, France, April 30, 1918.

³"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 3-5.

⁴S.P.A.D., Société pour l'Aviation et ses Dérivés. The name of the manufacturing firm.

⁵"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 11.

[The I Corps Observation Group was assigned for duty to the tactical control of the French XXXVII Army Corps and the administrative control of the American I Army Corps.⁶ The portion of the front assigned for the Group's activities extended from Flirey to Apremont, a distance of eight miles.] When the Group arrived, no major operations were under way nor were any foreseen in the immediate future. Defensive positions were strongly organized by lines of trenches and barbed wire entanglements. Infantry units were supported by the usual complement of divisional artillery entrenched in carefully prepared positions. The situation in the air over the American lines was satisfactory.⁷ [Two American pursuit squadrons stationed at Toul were available for the aerial defense of the sector.⁸ Since this front was relatively inactive, these were sufficient.]

The situation of the German forces on the ground was essentially the same as on the Allied side. Front lines were strongly organized for defense by means of trenches, barbed wire entanglements, and artillery. In the air the enemy was weak although isolated observation planes were reported from time to time. [No pursuit formations of more than five planes were operating] and the presence of pursuit planes over the sector even in small numbers was rare. [The enemy's aerial defense was built around a substantial and efficient

⁶General Order Number 71, General Headquarters, American Expeditionary Forces, France, May 7, 1918.

⁷Intelligence Reports of the 3d Division, American Expeditionary Forces, June, 1918, in Department of the Army, United States Army in the World War, 1917-1919, III, 556.

⁸The 94th and 95th Aero Squadrons.

mobile anti-aircraft artillery.)

[The primary mission of the I Corps Observation Group was to inform the Allied command of the general situation within the enemy lines by means of visual and photographic reconnaissance.] Whenever necessary the Group adjusted artillery fire and remained ready to accomplish contact patrols in case of attack. This meant that it had to train American ground troops in the use of radio and signal panels.

[The I Corps Observation Group was not expected to produce any important tactical results or render any great assistance in the conduct of operations at this time.] This tour of duty on a quiet front was to complete the schooling of pilots and observers and make them more competent to undertake intensive operations elsewhere on a large and more complete scale.⁹

[Major Lewis Brereton, the Group Commander,] organized his headquarters as follows: adjutant, who was responsible for routine administration; supply officer, who supervised the technical and supply; transportation officer, who dealt with the transportation problems arising in the Group; and operations officer, who was responsible for the successful conduct of aerial operations. The operations officer kept in touch with the command posts of combat troops and decided what the Group could do to aid them. The responsibility for collecting, compiling, and distributing all tactical reports, orders, and bulletins, and for assigning daily missions to each squadron fell on this officer.¹⁰

⁹"Tactical History, Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 4.

¹⁰Elmer R. Haslett, "Notes on the Duties of the Operations Officer of an Observation Squadron or Group," Weekly Training Bulletin, No. 1 (October 13, 1918), in J, Hy AS AEF, Vol. 1, p. 119.

The Intelligence Section of the American Expeditionary Forces General Staff assigned an intelligence officer to the Group to collect, analyze and distribute information pertaining to aerial operations. The interpretation of aerial photographs was accomplished under his direction, and he was assisted in each case by the observer who had carried out the photographic reconnaissance.

The photographic officer supervised installation of photographic apparatus aboard the airplanes of the squadrons and supervised the printing of photographs. The radio officer was responsible for proper functioning of the radio equipment of each squadron and the establishment of radio liaison between the Group headquarters and the command posts on the front lines. He acted as technical advisor and instructor for the entire Group in matters pertaining to the operation of airplane and ground radios.

The operations room, an information and intelligence center, was installed at the Group headquarters. Large-scale maps of the Toul Sector and of the enemy's defensive organization, charts, diagrams, and tabulations of all available tactical and technical information collected by the operations and intelligence officers were displayed in this room. Technical books and pamphlets were kept on file for the individual use of pilots and observers.

A laboratory and shop for minor repairs of photographic apparatus was installed under the direction of the photographic officer to supplement the facilities of the photographic truck and trailer. A Group radio station was organized by the radio officer using the radio equipment of one of the squadrons as its base. This station was

equipped with sending and receiving apparatus and with an artillery spark-type receiver for short wave messages from airplanes.

For defense against enemy air raids, the hangars and huts were widely separated and irregularly dispersed. Camouflage nets were spread across hangars, and the roofs of huts were covered with boughs. Lighted windows were screened after sundown. Dugouts heavily shored with logs were constructed, and anti-aircraft machine guns were deployed about the airdrome.¹¹

The administrative staff and tactical staff of each squadron in the I Corps Observation Group were made up of the following: a squadron commanding officer, three other pilots designated flight commanders, two observers designated operations and assistant operations officers, 15 additional pilots of whom three were designated deputy flight commanders, and 16 additional observers. A squadron was divided into three sections of six airplane teams each; each section, known as a flight, was given an unofficial alphabetical or numerical designation.

Three technical sections, each having an important bearing on flying activities, formed a part of each squadron. The engineering department was headed by the squadron engineer and was made up of the motor mechanic personnel of the squadron, including the machine shop and airplane repair units. This department was responsible for the mechanical efficiency of motors and planes. The armament department, headed by an ordnance officer and assisted by a staff of gunsmiths, was responsible for the maintenance and repair of the airplane machine guns.

¹¹"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 2.

This department was also responsible for the supply of machine gun ammunition, Very pistols, signal rockets, and metal containers for dropping messages to the ground.¹² The squadron radio section, headed by a Signal Corps officer, was responsible for the installation and proper functioning of wireless equipment.

[The group operations officer made these general assignments: to the 1st Aero Squadron, long distance photographic missions, adjustment of divisional heavy artillery fire, and long distance visual reconnaissance; to the 12th Aero Squadron and the 88th Aero Squadron, short-range visual reconnaissance, short-range photographic missions, adjustment of light artillery fire, and infantry contact patrols.¹³]

The assignment of specific pilots and observers for a particular mission was made by the squadron operations officer. Soon after receiving the squadron's mission assignment from the Group headquarters, the squadron operations officer prepared a schedule of the following day's work with the assignment, by name, of the pilot and observer who would comprise the team to carry out the mission contemplated. Copies of this schedule were posted on bulletin boards in the operations room, the mess halls, and the tent for pilots and observers located at the flying field; other copies were distributed to the squadron radio and armament officers and to the group photographic

¹²United States, AEF, Air Service, Manual of Initial Equipment and General Information for Service Squadrons in the Air Service, American Expeditionary Forces, 1918, in I, Hy AS AEF, Vol. 3, p. 55.

¹³Letter to the Director of Air Service, French Sixth Army from the Chief of Air Service, I Army Corps, American Expeditionary Forces, July 9, 1918, in Department of the Army, United States Army in the World War, 1917-1919, III, 397-398.

officer for whatever preparation might be required.¹⁴

[In so far as conditions permitted, it was the practice to assign one flight from each squadron to missions for the current day. A second flight was held in "alert" (reserve) condition, the members of that flight to remain available for the performance of any urgent missions.] The remaining flight was off duty unless exceptional circumstances arose. Advance schedules for each day were issued by the squadron operations officer in order to allow sufficient time for proper preparation for missions by pilots and observers as well as for the accomplishment of necessary work on airplanes and equipment by the technical officers of squadrons and the group.¹⁵

The interior communications of the I Corps Observation Group consisted of direct telephone lines from Group to squadron headquarters and to the pilot and observer tent on the field. Long distance lines to tactical command posts and to higher Air Service headquarters were also maintained. Radio liaison between the Group and all points in the area was established from the radio station. Two pigeon lofts stationed at the airdrome made contact from advanced units on the front possible. The following types of communication between airplanes and ground units were possible: radio, visual signals (rockets), and dropped written messages. Arrangements were made with Allied artillery

¹⁴The mission assignments for the 1st Aero Squadron dated May 25, 1918, were typical. The names of the pilots and observers for two visual and one photographic reconnaissance flights and the area to be studied were specified. "Observation Material World War I (largely French, some German)," in USAF HD Archives.

¹⁵"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 18-19.

commanders for rapid communication by radio-equipped airplanes with designated artillery batteries to fire upon enemy troop columns on roads and batteries in action. Reconnaissance planes were to be prepared at all times to call the batteries designated for this work whenever suitable targets were observed.¹⁶

[A routine schedule of operations for each day included one close-range observation flight over the Toul Sector at daylight, one flight between 9 and 12 in the morning, one between 2 and 5 in the afternoon, and a final flight shortly before sundown. At dusk the flashes of enemy batteries in action could easily be distinguished and their location reported. One observation team remained on duty at the airdrome ready for immediate departure in case of an emergency.]

[Special missions,] such as artillery adjustments, photographic and long distance reconnaissance, reconnaissance of particular localities, contact patrols, and training exercises [were usually prepared under the direction of the group or squadron operations officer on the day preceding the date set for the accomplishment of the mission.] The team to execute the work was designated at that time.¹⁷

[The short-range reconnaissance mission required preparation of only one airplane.] First the observer was notified of his assignment to the mission and instructed by the operations officer in the details of terrain, type of information desired, tactical situation, and in

¹⁶ Ibid., pp. 2 ff.

¹⁷ For examples of this type of mission assignment see "Observation Material World War I (largely French, some German)," in USAF HD Archives.

communications data. The observer then conferred with his pilot. The pilot supervised servicing of his guns and the testing and tune-up of the plane. The observer requested the mounting of radio equipment and the assignment of a wave length; he then saw to the loading and mounting of his guns by the armament section. Both provided themselves with maps from the operations room. Before leaving on the mission they checked out at the assembly tent, signing their names and indicating the nature of their mission.¹⁸

Once in the air over the field, the observer tested his radio and signaled to his pilot to proceed to the lines only upon receiving the panel signal "understood" from the radio station. When the mission was under way the observer ordinarily directed the course of the plane by hand signals or inter-phone communication with the pilot.¹⁹ Observers undertaking short-range reconnaissance missions reported directly by radio to the division command posts any unusual developments in the enemy's area.²⁰ If the situation warranted and the conditions permitted, observation teams assisted the rapid adjustment of artillery fire by means of prearranged signals.

Upon return from the mission the team checked in at the

¹⁸"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 20.

¹⁹Observers sometimes used reins attached to the pilot's arms to guide him over the target. "Notes on Aviation During the World War. Collected from Various Sources and Issued by Various Countries, 1915-1919," stencil number 64, dated June 8, 1918, in USAF HD Archives.

²⁰Letter to the Director of Air Service, French Sixth Army from the Chief of Air Service, I Army Corps, American Expeditionary Forces, July 9, 1918, in Department of the Army, United States Army in the World War, 1917-1919, III, 398.

assembly tent, noting briefly the conditions encountered, any abnormal incidents, and the duration of the flight. The pilot then saw to the care of the plane, motor, armament, and radio equipment and reported any faults in the functioning of his equipment. The observer proceeded immediately to the operations room where he discussed the results of his mission with the operations and intelligence officers and prepared a written report. The operations and intelligence officers then communicated the results of the mission to the tactical authorities concerned. The observer's written report was carefully filed for record; no mission was considered accomplished until a full report had been submitted.

[Long-range reconnaissance differed from the short-range in that no radio was employed.] [For added security the plane undertaking the mission was accompanied by two or more protection planes from the same squadron.] Details of preparation, execution, and reporting were essentially the same for both long-range and short-range missions.

[The photographic mission resembled closely the long-range reconnaissance.] [Since aerial photographs were ordinarily taken at altitudes which made encounter with enemy pursuit patrols a possibility, two protecting planes were usually furnished even for photographic missions near friendly lines.] The observer detailed to a photographic reconnaissance mission studied carefully the maps of the territory to be photographed and secured the necessary photographic planes. After the camera had been mounted in the airplane designated for the flight, the mission then proceeded in the ordinary way with the photographic plane leading. Upon completion of the mission, planes and equipment

were checked by the pilots flying the formation, and observers made the customary reports. The observer taking the photographs helped to identify the plates after development and assisted the intelligence officer in interpreting them. The mission was not considered complete until the plates had been identified and the report made to the tactical units.²¹

Preparations for artillery adjustment missions were similar to those for short-range reconnaissance missions. The observer, just before leaving for his mission, announced his departure by telephone to the artillery battery with which he was about to conduct fire. Upon return to the airdrome the observer and pilot followed the same routine prescribed for the ordinary reconnaissance flight. In reporting, the observer stated, in addition to any generalizations regarding the incidents and results of the mission, the number of shots fired and the number of shots observed.²²

After completion of the technical and tactical preliminary preparations, the I Corps Observation Group undertook actual combat operations. The maiden flight over the front lines was accomplished on April 11, 1918, and the following day the Group's initial combat occurred when First Lieutenant Arthur J. Coyle of the 1st Aero Squadron was attacked by three enemy planes. The encounter was not decisive;

²¹The system of notation used on American Air Service aerial photographs was based on French procedures as outlined in General Order Number 52, General Headquarters, American Expeditionary Forces, France, April 5, 1918. Cf. General Order Number 80, General Headquarters, American Expeditionary Forces, France, May 28, 1918.

²²"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 23-24.

Coyle returned to his base with one bullet hole in his plane.²³

Numerous artillery adjustments, neither important in results nor arduous in execution, were successfully carried out by the Group, particularly by the 12th Aero Squadron. [The 1st Aero Squadron conducted successful photographic missions at frequent intervals.²⁴

[The 38th Squadron, which joined the Group late in May, was particularly active in effecting close-range reconnaissance of the enemy sector, although it was afforded only one or two opportunities to undertake close-range photographic missions, long-range reconnaissance, and artillery adjustments.

[It should be noted that the work of the Group was seldom hampered by the presence of enemy pursuit aircraft. Practically no experience in combat was gained.] On the other hand the enemy anti-aircraft fire in the Toul Sector was exceedingly heavy, active, and accurate.] Pilots of the Group became adept at evading anti-aircraft fire after flying for a month in the Toul Sector. Infantry contact patrols were attempted during the Seicheprey engagement on April 20-21, 1918. This brief action was planned to demonstrate the readiness of American troops for offensive operations, but it gave bloody evidence of the difficulties of advancing against mechanized fire power. Infantry contact patrols were unsuccessful partly because of the incomplete training of the ground troops who showed no panels when

²³"History of the 1st Aero Squadron," 1918, E, Hy AS AEF, Vol. 1, p. 17.

²⁴"Aerial Observation," Air Service Bulletin, III, No 102 (April 17, 1918), 1, in L, Hy AS AEF, Vol. 7.

planes called for the staking of the line.²⁵

Some panel exercises for the instruction of the radio and panel crews of artillery units were carried out successfully. On one occasion, during maneuvers with the 26th Division in a rear area, airplane cooperation in training exercises was called for; the line was staked upon the call of the airplane observer and at frequent intervals messages were dropped at the command posts. This experience may have been of some value to the ground troops, but it taught the personnel in the Group nothing not previously understood.²⁶

During the stay at Ourches the I Corps Observation Group contributed nothing of prime importance to operations. Its presence was valuable to other arms chiefly because of the negative information it furnished regarding enemy activities. The constant watch maintained along the lines by planes of the Group made difficult any secret preparations by the enemy for attack on a large scale. Detection of increased enemy transport, artillery, dumps, and cantonments was virtually certain. During the two and one half months spent by the Group in the Toul Sector, observation assignments were light and activities were limited. One efficient squadron would have been sufficient to accomplish all the missions required by the tactical situation.

The time spent on the Toul Sector was invaluable to the I Corps Observation Group itself. The organization which it evolved there

²⁵"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 14.

²⁶"History of the 88th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, pp. 77-79.

proved to be successful and efficient and served as a base for the formation of all succeeding observation units. From time to time minor changes developed in meeting varying situations, but the basic principles of organization established at Ourches were continued throughout the war.

In the more arduous observation operations which followed during the campaigns of the summer and fall of 1918, the experience in matters of routine and the confidence gained by the flying personnel at Ourches stood them in good stead. With the possible exceptions of actual combat against armed enemy pursuit planes and cooperation with ground troops, no essentials of a liberal flying training were lacking.

Liaison between the Group and infantry and artillery units was practically nonexistent. No close personal understanding based on an agreement on tactical principles between air and ground units ever existed in the Toul Sector. The activities of the Air Service were as unfamiliar to the field commanders as the operations of the line units were to the Air Service. As a precautionary measure, in case of increased enemy activity, full liaison and complete tactical understanding should have been established. On the other hand, the situation at the time demanded no such intimacy between Air Service and units on the front lines as later became indispensable. Lacking the incentive of urgency, neither the ground commanders nor the Air Service leaders realized the gap that remained to be bridged. Later operations of the 1st Corps Observation Group at Château Thierry were handicapped by this lack of liaison experience.

On June 3, 1918, the 12th Squadron was ordered to the Baccarat

Sector and was temporarily detached from the I Corps Observation Group on June 27, 1918, to operate alone with the 42d and 77th Divisions.²⁷ The 88th Squadron left the I Corps Observation Group on July 17, 1918, to become the nucleus for organizing the III Corps Observation Group.²⁸

Army Observation

During the inactive period on the Toul Sector in the late spring and summer of 1918 and up to the St. Mihiel Offensive which commenced in the middle of September, Air Service army observation operations were carried out by the 91st Aero Squadron. Prior to its assignment to the First Army, which was organized on August 10, 1918, this Squadron worked under orders of the Chef de l'Aéronautique of the French Eighth Army. The First Army Observation Group was not formed until September 6, 1918, when with the 91st Squadron as its nucleus, two other units--the 9th and the 24th Aero Squadrons--were added. Neither of these squadrons saw combat before the St. Mihiel offensive.

The 91st Aero Squadron arrived in the Zone of Advance on December 14, 1917, and was stationed temporarily at the aviation field near Amanty to receive equipment and to carry out a program of training before taking up active service flying at the front. At this time the Squadron had no flying officers assigned to it. Several pilots arrived during the first two months of 1918, and on February 24, 1918, when

²⁷"History of the 12th Aero Squadron," 1918, E, Hy AS AEF, Vol. 3, p. 49.

²⁸"History of the 88th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, p. 90.

Major John N. Reynolds took command, there were 20 pilots assigned to the 91st Squadron.²⁹

At that time the Squadron had not received its equipment, but the pilots gained some knowledge of observation operations by piloting the students of the I Corps Observation Training Center at Gondrecourt. This flying was done in French Avion Renault aircraft, which had been assigned to the I Corps Training Center. These pilots had no experience in aerial gunnery except what little they were able to pick up for themselves. Four had been sent to Cazaux but they had received no instruction there. On April 24, 1918, the Squadron's permanent equipment began to arrive. The planes were Salmson 2A2's equipped with Salmson 260 horsepower radial engines and fixed Vickers and twin Lewis machine guns. The pilots trained in the new planes, and the mechanics were given courses of instruction in their upkeep at the Salmson motor factory. After the full complement of airplanes had been received and the fliers were considered sufficiently well trained, orders were received to proceed to the front for active service over the lines. On May 24, 1918, the 91st Squadron moved to the airdrome at Gondreville-sur-Moselle.³⁰

At the beginning of operations the front line was about 20 miles from the airfield at Gondreville. This was far enough from the enemy to provide reasonable security, thus allowing for a semipermanent camp,

²⁹"History of the 91st Aero Squadron," 1918, E, Hy AS AEF, Vol. 10, p. 7.

³⁰"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, p. 201.

and near enough to permit long distance reconnaissance to be carried out in spite of the handicaps of high-altitude flying and limited fuel-carrying capacity. The field itself was located south of the Toul-Nancy road. The southern half of the installation was reserved for the 91st Squadron; the French 41st Squadron occupied the northern portion of the field. The landing strip, level and well drained, was well suited to flying. There were four well-camouflaged temporary hangars; three were used as flight hangars and the fourth to house surplus planes. Supply, engineering, and repair shops were located near the hangars.

From the standpoint of security arrangements at the Gondreville airfield proved effective, as concentration of men and supplies was avoided. Measures were taken for defense of the post against attacks from the air. Machine guns were mounted at several points, and shelter trenches were dug. The greatest disadvantage of the location of the airdrome was that it was situated at the crossing of two main roads, making it an easy target for bombers to find. Although the Germans made several attempts to bomb the field during the summer, they did not succeed in causing any damage. The entire camp was lighted by electricity, which was a decided asset since so much night work and study was necessary. This was especially valuable in the photographic laboratory where the greater part of the work was done at night.³¹

Prior to the move from Amanty only three observers had reported for duty. Immediately after the move to the front, the remaining

³¹"History of the 91st Aero Squadron," 1918, E, Hy AS AEF, Vol. 10, pp. 23-29.

observers began to arrive; fifteen had reported for duty by June 11.³² The observers of the 91st Squadron had not received adequate preparation for army observation work before being sent to the front. Nine of them were artillery officers who had been given instruction with a French squadron behind the lines. They had received no systematic instruction; their training consisted of radio practice, one or two practice réglages with smoke bombs, and one mission for the purpose of photographing isolated objectives. They had then been given instruction in machine gun operation and in ground shooting at the Aerial Gunnery School at Cazaux. Unfortunately, weather conditions gave little or no opportunity for shooting in the air. Before being sent to the front, none of these officers had flown over ten hours. The remainder of the observers, with one exception, had attended the I Corps Observation Training Center at Gondrecourt, and had received somewhat better training than the artillery officers. One observer had been through the Observation School at Fort Sill, Oklahoma. All of them had first been sent to the front with French squadrons. This policy was admirable in that the observers, in spite of inadequate schooling, worked under fire with experienced pilots who knew the flying game through and through.³³

Full-scale flying operations could not be started immediately, principally because of the poor quality of the propellers and spark plugs furnished by the French. Although it was unwise to attempt long-range missions with these serious handicaps, short patrols were carried out to familiarize the pilots and observers with the principal

³²Ibid., p. 8.

³³Ibid., pp. 8-10.

features of the Toul Sector. In the course of a few days every flier in the 91st was given the opportunity to fly along the front lines. Early in June, 22 new propellers and a fresh shipment of spark plugs arrived, and Major Reynolds reported that the 91st Squadron was ready for duty.³⁴

On June 6, 1918, an operations order was received from the Chef de l'Aéronautique of the French Eighth Army, through the Chief of Air Service, I Corps, directing the 91st Squadron to perform visual and photographic reconnaissances of the enemy's rear area, and to provide adjustment of fire for the army artillery.³⁵ This latter assignment was never actually carried out, for during the early part of the summer army artillery was rarely used. A later order limited the activities of the Squadron simply to reconnaissance.³⁶ The sector assigned to the French Eighth Army was bounded as follows: on the west, Côtes-de-Meuse; on the north, the railroad running between Conflans and Metz; on the east, the highway from Metz to Romeny. Maps were furnished showing the routes to be covered on visual and photographic missions, the order of their importance being indicated by numbers. The missions for June covered five visual and nine photographic routes to be

³⁴"History of the 91st Aero Squadron, 1917-1934," p. 1, in USAF HD Archives.

³⁵Operations Order Number 4, Chief of Air Service, I Corps, American Expeditionary Forces, June 6, 1918, C, Hy AS AEF, Vol. 12, pp. 37-42. Army artillery units were usually located well behind the lines and took their orders directly from the general headquarters of the army. They were equipped with the heaviest guns available. Most artillery batteries were responsible to divisional commanders.

³⁶Operations Order Number 7, Chief of Air Service, I Corps, American Expeditionary Forces, July 2, 1918, in ibid., p. 49.

reconnoitered as frequently and completely as possible.³⁷ This method of assigning routine missions for each month was continued through July and August, and until the separation of the Squadron from French jurisdiction. The limits of the sector were gradually extended to the east and north.³⁸ As the attack at St. Mihiel grew imminent, the northern boundary was entirely removed and missions carried out to an indefinite depth.

Up to this time there had been no systematic investigation of the Toul Sector, as no specific theater of operations had been assigned, nor had the exact nature of the Squadron's mission been defined. Upon receipt of the operations order of June 6, 1918, intensive studies were begun. Plans for an observers' room had been made previously, and the room was furnished with large-scale maps of the sector and photographs of towns and military works in the enemy's territory. Pilots and observers were instructed to study the Toul Sector carefully. For a few weeks this study was carried out by each man independently, but the results were not entirely satisfactory. On June 21 an examination was given to determine just how much each man knew about the terrain and situation, and the results of this evaluation suggested that more could be gained if future instruction were carried out in a systematic way. A course of study was arranged and quizzes

³⁷Operations Order Number 4, Chief of Air Service, I Corps, American Expeditionary Forces, June 6, 1918, in ibid, pp. 39-40.

³⁸William Mitchell, "Plan of Reconnaissance for the Army Aviation," July 14, 1918, in "Observation Material World War I (largely French, some German)," in USAF HD Archives. Mitchell's plan is quite similar to the French observation aviation programs which are included (in translation and original copies) in this same file.

were given at frequent intervals. These tests were not to grade the fliers, but merely to enable each man to determine his own deficiencies.

Familiarity with enemy-held towns, supply dumps, and airdromes was obtained by means of a course of study of aerial photographs posted on large cards, with the names of the various places shown under each. These photographs were studied for several days, after which the captions were removed and the towns, dumps, and airfields named from memory. The effect of this instruction was apparent not only in the amount and character of the information brought back by the observers, but in the work of the pilots as well. Photographic routes were covered more accurately; the pilots themselves carried out independent observation and returned with valuable reports.³⁹

The initial visual reconnaissance over enemy territory was carried out late in the afternoon of June 7, 1918. A formation of four planes was accompanied by five protection planes from the 1st Pursuit Group.⁴⁰ This mission was carried out at an altitude of 10,000 feet. Active and accurate anti-aircraft fire was encountered, and practically every plane received some damage from fragments of high-explosive shells. It was decided, therefore, to carry out future missions at an altitude of 15,000 feet.⁴¹

Flying at this added height had several advantages. First,

³⁹"History of the 91st Aero Squadron," E, Hy AS AEF, Vol. 10, pp. 11-14.

⁴⁰"History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, p. 1.

⁴¹"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, p. 43.

damage from anti-aircraft fire was significantly lessened, due to the difficulty in ranging. Second, visibility was extended, allowing a greater amount of territory to be reconnoitered on a given route, on both visual and photographic missions. Third, at this altitude the Salmson plane was more than a match for any enemy single-seater in the matter of speed and unless surprised, could successfully give combat.

At first visual reconnaissances were carried out between the hours of eight in the morning and four in the afternoon. Experience soon showed that this practice exposed men and planes to great danger, without obtaining results commensurate with the risk. Since the Germans made practically all troop movements under the cover of darkness, it was decided to carry out visual missions during only the early and late hours of the day. The early morning reconnaissance proved to be the most valuable for it was these missions which caught the final movements of the night's activities. When the weather was at all suited for flying, the atmospheric conditions at early morning were actually advantageous; the air was free from haze, and though there was usually a certain amount of mist in the Moselle valley, the remainder of the Toul Sector was so high that visibility was excellent over practically the whole area. Army observation required almost perfect weather conditions as a great deal of the work consisted of photography carried on at high altitudes. There was no great amount of rain during the summer, and therefore the field was in such condition that the most could be made of every clear day.

Formations of three and four planes were sent out at daylight, but by the time proper altitude was reached it was too late to obtain

information of value. It was necessary for the planes to be over enemy territory as soon as it became light. Formation flying was impossible in the dark. Single planes were henceforth used, each covering an independent route and starting out an hour before daybreak. This arrangement proved most satisfactory. The single planes gained their altitude and arrived at predetermined points far back in enemy territory just as it became light enough for observation. The sector could then be reconnoitered and the plane well on its way home with the information before enemy planes could take off, climb to the observer's altitude, and give combat.

The evening reconnaissance proved to be of little value both on account of atmospheric conditions and because the enemy rarely commenced his activity until well after dark. On the Toul Sector there was almost always a thick haze which reached a height of 12,000 feet by afternoon, greatly hindering observation, especially in the direction of the sun, and intensifying the danger of surprise attacks by enemy pursuit planes. Conditions of visibility steadily became worse during these missions. Although some indication of enemy movement might be picked up just as it became dark, it was impossible for the plane to remain to obtain more data, for the 91st Aero Squadron had neither the equipment nor the trained personnel for night flying.

Occasionally special visual reconnaissances were carried out during daylight hours, and formations were employed. In such cases it was found advantageous to divide the assignment among the observers, the observer in the lead plane observing primarily the railroads, another the ammunition and matériel dumps, and a third the roads and

barracks. One or more observers in each formation, the number depending on the known strength and aggressiveness of the enemy, would devote all attention to the air, watching for hostile craft.

The operations order of June 6, 1918, stated that all photographs were to be taken with a 52 cm. camera, at an altitude of 17,000 feet.⁴² It was seldom possible to climb to this altitude and the majority of the photographic work was done at about 15,000 feet. These technical problems were much more easily resolved than were the tactical difficulties.

Since pursuit planes, because of their limited fuel capacity, could not be used for protection of photographic missions which involved long distance flights behind enemy lines, formations of three or four observation planes were employed. At first only the lead plane was equipped with a camera. The other planes acted as protection but maneuvered about to pick up whatever information they could. This method had two disadvantages: first, if the leading plane developed motor trouble or could not accomplish its mission for any reason, the sortie was likely to be a complete failure; second, because of the limited number of plates carried by one plane, the maximum being 48, the area photographed would be comparatively small.

The use of cameras in two planes of the formation was then tried. This had the advantage that if one plane was forced to leave the formation, the other photographic plane could complete the mission. Although greater reliability was assured by this method, it left much

⁴²Operations Order Number 4, Chief of Air Service, I Corps, American Expeditionary Forces, June 6, 1918, C, Hy AS AEF, Vol. 12, p. 40.

to be desired, as no greater amount of territory was covered. The chance of obtaining good photographs was greater, however, if both planes succeeded in covering the course. Later two photographic planes flew a half mile apart, protected by a formation above them; but this loose formation proved unsuccessful due to its vulnerability when attacked by the enemy.

A more satisfactory plan was finally adopted for use on long photographic reconnaissances. Every plane in the formation was equipped with a camera, carried a maximum number of photographic plates, and had its regular machine gun armament for pilot and observer. The flight commander would lead the formation over the lines and expose his plates while the other planes afforded him protection. The leader would then drop out of first place while the next plane took his position and covered its particular course, the former leader flying in the rear. This maneuver was repeated until the entire mission was completed. Although this method gave satisfaction, it was awkward in that it involved a continual change in the formation, and necessitated flying under a constantly changing leadership. There was also danger that the continuity of the photographic mosaic might be lost during the changes in the flying position at the end of each segment of the mission.

One flight equipped each machine with a camera, and had the flight commander lead the formation throughout the entire mission. The leading plane photographed a certain portion of the course and just before the end of his route was reached the observer in the next plane began to operate his camera. In this way the integrity of the formation was preserved and the continuity of the assemblage assured, while

protection was given by the planes not actually engaged in taking photographs. These tactical and technical methods were developed slowly as the result of painful experience.⁴³

At the beginning of operations, the enemy's aerial activity was slight. This was probably due to the fact that the Toul Sector had seen no real combat since the beginning of the war, and the great concentration of the German Air Service was then to the west, in the region of Soissons. The hostile pursuit planes encountered were mainly Pfalz and Albatros scouts in patrols of three or four. They rarely offered to attack a formation, but contented themselves with remaining at a distance taking shots at long range or following a flight, ready to attack any plane which became separated from the formation. The immunity from attack when in close formation was surprising to the observation teams of the 91st Squadron.⁴⁴ During the summer of 1918 the Germans patrolled their back areas inadequately. Extended missions were often carried out to a considerable depth into the enemy back areas without interference from or even the presence of hostile aircraft.

The German Fokker D 7 first appeared in the Toul Sector in August, 1918. The pilots of these machines showed more aggressiveness than had their predecessors. They were aided in their work by a system of anti-aircraft signals, which had apparently been arranged for the purpose of indicating the position of Allied planes. The enemy knew that the 91st Squadron performed reconnaissances of Metz and

⁴³"History of the 91st Aero Squadron," 1918, E, Hy AS AEF, Vol. 10, pp. 41-54.

⁴⁴Ibid., p. 63.

Conflans several times a week. As soon as a formation of observation planes crossed the lines this intelligence would be transmitted to anti-aircraft batteries near these cities. The Germans would fire a signal salvo and, by the time the formation had arrived, a patrol of enemy aircraft would be found waiting over the objective.⁴⁵

Beginning on the first day of September, there was a noticeable increase in the enemy's air forces in the Toul Sector. Whereas combat formerly had taken place only deep in the German back areas, strong patrols were now encountered barely across the enemy lines. Little damage resulted from the new concentration of German air forces. Evidently the Germans suspected an attack, and were attempting to screen their preparations for defense. Observation indicated large troop movements and a strengthening of defenses, especially the Hindenburg Line.

On August 23, 1918, the 24th Aero Squadron, equipped with Salmson planes, moved to the northern portion of the Gondreville airfield. The French 41st Squadron had left only a few days before and additional hangars and barracks were erected to take care of the greater amount of equipment and increased personnel of an American army observation squadron.⁴⁶ On September 6, 1918, the First Army Observation Group was formed, consisting of the 9th, 24th, and 91st Aero Squadrons.⁴⁷

⁴⁵ "History of the 91st Aero Squadron, 1918, 1917-1934," p. 2, in USAF HD Archives.

⁴⁶ "History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, pp. 210-211.

⁴⁷ Ibid., p. 202; "History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, p. 2.

At this time the 9th Aero Squadron, equipped with French Bréguets for night reconnaissance, was stationed at Amanty. Neither the 24th nor the 9th Squadron began active operations in the Toul Sector until the St. Mihiel action in September, 1918.

Bombardment

[Air Service bombardment had its beginning in the Toul Sector on May 29, 1918, when the 96th Aero Squadron was assigned to Amanty airdrome.⁴⁸] For months this was the only American bombardment unit in active operation against the enemy. The personnel of this organization had received some training from both the French and the British. [The 96th Squadron was equipped with ten old Bréguet 14 B2's which constantly needed repairs. Previously this unit had been stationed at Clermont-Ferrand where the mechanics had studied Bréguet planes and Renault engines. They made good use of this study and during the early months of 1918 when spare parts were not obtainable, old French farming implements were sometimes used to repair the Bréguets.⁴⁹]

[The Bréguet was considered an excellent plane. It could carry over 600 pounds of bombs to 13,000 feet in 35 minutes, was fast at high altitudes, and carried enough fuel for almost five hours in the

⁴⁸"Service Squadrons on the Front at the Termination of the War," A, Hy AS AEF, Vol. 6, p. 208. See also General Order Number 81, General Headquarters, American Expeditionary Forces, France, May 29, 1918.

⁴⁹"Lessons Learned by the 2d Day Bombardment Group," 1918, A, Hy AS AEF, Vol. 15, pp. 289-290.

air.) The planes were well constructed with few exposed controls. Visibility was good and the pilot and observer were close together. A pair of Lewis machine guns stripped of cooling devices was mounted on a tourelle or turret for the observer's use; a Vickers gun synchronized to shoot through the propeller was the pilot's weapon.⁵⁰

[The first American Air Service bombardment raid took place on June 12, 1918, against the railroad yards at Dommary Baroncourt. Eight planes of the 96th Aero Squadron led by Major Harry M. Brown, the commanding officer of the Squadron, took off from Amanty on this mission; two planes returned because of motor trouble. The remaining aircraft dropped their bombs and all returned despite an attack by three enemy planes.⁵¹] On July 10 a formation of six planes led by Major Brown headed for the primary target of Conflans; secondary targets were small towns along the railroad from Conflans to Thiaucourt. The flight, which got off to a late start, left after six in the evening because the weather had been bad all day, lost its way in a windstorm, ran out of gas, and landed after dark behind German lines. All of the planes were captured intact. It is reported that the Germans dropped a message on an American airdrome which read, "We thank you for the fine airplanes and equipment which you have sent us, but what shall we do with the Major?"⁵² This loss crippled the 96th Squadron for several weeks.]

⁵⁰"History of the 96th Aero Squadron," 1918, E, Hy AS AEF, Vol. 15, pp. 209-210.

⁵¹"Tactical History of Day Bombardment from the Beginning to the St. Mihiel Offensive," 1918, D, Hy AS AEF, Vol. 1, p. 128.

⁵²Levine, Mitchell: Pioneer of Air Power, p. 125.

Pursuit

The Toul Sector also served as a practice ground for pursuit squadrons. [The 95th Aero Squadron, the first American pursuit squadron in France, had arrived there in February, 1918, but was not equipped with planes until the first week in March.] On March 15 pursuit patrol operations began, using unarmed Nieuport 28's led by a French pilot in a Spad. These flights were risky undertakings. One American plane was shot down in flames while on one of these foolish missions.

[Later that same month 16 pilots of the Squadron were ordered to take a course in aerial gunnery at Cazaux and this organization was even further delayed in getting into combat.]⁵³

[Meanwhile, the 94th Aero Squadron, later to become famous as the "Hat in the Ring" squadron, had moved to Gengault airdrome near Toul.] Here it began operations on April 14, 1918, when Lieutenants Alan F. Wilson and Douglass Campbell each shot down an enemy plane.⁵⁴ Subsequently, [First Lieutenant Campbell became the first American Ace,⁵⁵ shooting down his fifth enemy aircraft on May 30, 1918.] Shortly thereafter Campbell was wounded and sent back to the United States.⁵⁶

⁵³Harold Hinton, Air Victory: The Men and Machines (New York: Harper and Bros., 1948), p. 28.

⁵⁴Harold E. Hartney, Up and at 'Em (Harrisburg, Pa.: Stackpole Sons, 1940), p. 247.

⁵⁵Edward V. Rickenbacker, Fighting the Flying Circus (New York: Frederick A. Stokes Co., 1919), p. 126. Although the Air Service declined to sanction the use of the word "Ace" in referring to fliers credited officially with five or more victories over enemy aircraft, it was used in France during World War I and has been used ever since.

⁵⁶Ibid., pp. 140-144.

Captain Edward V. Rickenbacker, later commanding officer of the 94th Squadron, became the second American Ace on May 31, and raised his score to 27 victories before the war was over to become America's leading Ace.⁵⁷ (On May 19, 1918, Major Raoul Lufbery, the commanding officer of the 94th Squadron, was killed in combat against a German observation plane when he fell from his burning plane.) Although he was third in the number of enemy planes accounted for, Lufbery is not included on most lists of American Aces because he downed his 17 enemy aircraft while fighting in a French organization.⁵⁸)

(In May, two more pursuit squadrons were sent to the front and the 1st Pursuit Group was formed, composed of the 27th, 94th, 95th, and 147th Pursuit Squadrons. Two German Rumplers flew over the Toul airfields on the day the 27th and 147th arrived. They passed over the American units at high altitudes and were not disturbed by anti-aircraft fire or aerial forces. A few days later an enemy plane scurried across the lines and dropped a detailed photograph of the airdrome with a message on it: "Welcome 27th and 147th. Prepare to meet thy doom."⁵⁹)

Fortunately some of the pilots had served with the French Air Service and their experience was invaluable in teaching the new pilots. Teamwork and formation flying were emphasized. Enemy planes were

⁵⁷ Official confirmation for one of these victories was not granted for thirty years. Maurer Maurer, "Another Victory for Rickenbacker," Air Power Historian, VII (April, 1960), 117-124.

⁵⁸ Gene Gurney and Mark P. Friedlander, Jr., Five Down and Glory: A History of the American Air Ace (New York: G. P. Putnam's Sons, 1958), pp. 46-47. Hereafter cited as Gurney, Five Down and Glory.

⁵⁹ Hartney, Up and at 'Em, p. 150. Hartney was commanding officer of the 1st Pursuit Group in World War I.

neither numerous nor aggressive and combats were infrequent.⁶⁰ During the summer of 1918, the 1st Pursuit Group concentrated its attacks against enemy planes which sought to interfere with British bombing raids and American observation operations. On numerous occasions enemy observation machines were shot down by American pilots. The pursuit squadrons, like the other Air Service squadrons, came out of the Toul Sector with excellent morale, and although they were far from being veteran fighting units, they were well equipped for more serious undertakings.

Balloons

The Toul Sector was also used for developing tactics and organization of American balloon companies. On February 26, 1918, the 2d Balloon Company, the first American Expeditionary Forces Air Service unit completely organized and equipped to operate with American troops, joined the 1st Division which was already in line at the front.⁶¹ This Company, insufficiently manned and inadequately trained, was scheduled to have gone to the training camps in western France for further instruction but was ordered to the front instead.⁶²

⁶⁰"History of the Organization, Development, and Growth of the 1st Pursuit Group," 1918, C, Hy AS AEF, Vol. 9, pp. 1-6.

⁶¹"History of the 2d Balloon Company," 1918, E, Hy AS AEF, Vol. 27, p. 4.

⁶²This was done through an error but it resulted in a great deal of controversy between Colonels William Mitchell and Frank Lahm as to which one was to have charge over the balloon units. Col. Lahm was the nominal head of the balloon unit but Col. Mitchell as Chief of Air Service, I Corps, took command and refused to allow Lahm to issue any orders. Mitchell, Memoirs of World War I, p. 182.

Two other balloon companies, the 1st and the 4th, reached the front in April, relieving French companies. Specialists from the French units remained with these American balloon companies until the latter became sufficiently adept. After the Americans achieved proficiency they undertook the training of newly arrived balloon units. Their mission was to regulate artillery fire, to locate targets, and to report all activity within the enemy lines by day and, when possible, by night.⁶³

Although artillery activity was limited in the Toul Sector, when it was necessary to regulate artillery fire the balloons were able to do so with dispatch because of the excellent telephone liaison which had been established. This communications system consisted of a network of lines to group headquarters, division headquarters, artillery brigade headquarters, anti-aircraft batteries, and neighboring artillery batteries.⁶⁴ It was necessary for the balloon units to instruct the other branches of the service in the uses, capabilities, and limitations of balloons.⁶⁵ Liaison with pursuit and observation squadrons was not all that could be desired and was never developed to any degree of perfection during any of the operations. During August, 1918,

⁶³"Tactical History of the Balloon Section: Training in the Toul Sector," 1918, F, Hy AS AEF, Vol. 2, p. 351.

⁶⁴Letter to the Director of Air Service, French Sixth Army from the Chief of Air Service, I Army Corps, American Expeditionary Forces, July 9, 1918, in Department of the Army, United States Army in the World War, 1917-1919, III, 398.

⁶⁵"Review of Balloon Activities, 1917-1918," 1918, O, Hy AS AEF, Vol. 6, p. 43.

however, liaison in the Toul Sector was established by means of conferences between pilots and balloon observers, and many improvements in methods of attack and defense were made.⁶⁶

⁶⁶Charles Chandler, "Balloon Section Report," December 31, 1918, F, Hy AS AEF, Vol. 1, pp. 8-9.

CHAPTER IX

OPERATIONS IN THE BACCARAT AND ST. DIÉ SECTORS AND ON THE VESLE RIVER

The 12th Aero Squadron in the Baccarat Sector

During the first week of June, 1918, the 12th Aero Squadron received notice that orders would be issued shortly for its movement to Flin in the Baccarat Sector, southeast of Lunéville.¹ Accordingly, an advance party of officers and enlisted men went forward to prepare the airdrome and buildings for the arrival of the Squadron. The location assigned for the airfield possessed little else than some newly erected hangars. Since a construction unit was not available, most of the 12th Squadron's effort was diverted to the preparation of the landing field, offices, and quarters. The tactical situation in the Baccarat Sector at the time, however, was such that the four days spent in getting the field into flying condition did not affect the efficiency of the Allied forces. The observation operations during this interval were carried out by a French squadron which the 12th was to relieve. In the 12th Aero Squadron's endeavors to complete the airdrome installations necessary to the conduct of flights over the front, an esprit de corps developed which proved invaluable in the

¹Elmer Haslett, Luck on the Wing (New York: E. P. Dutton and Co., 1920), pp. 50-51.

months to come.²

After the completion of the building projects, all that was required was to place the radio equipment in operation, to install the photographic equipment and to await the assignment of a branch intelligence officer from divisional headquarters. The defense of the airdrome was organized along the same lines as that used in the Toul Sector. Carefully prepared plans for defense and evacuation of the area in case of hostile attack were received from the Commandant de la Secteur Aéronautique, VI Corps, French Eighth Army. These plans were carefully studied and steps necessary to carry them out were taken. Telephone lines were constructed connecting the Squadron offices, barracks, and hangars; long distance telephone lines to divisional tactical command posts and to higher Air Service headquarters were also secured.³

During its first week in the Baccarat Sector, the 12th Aero Squadron gave up its Avion Renault airplanes and received 18 Salmson two-seater observation planes equipped with 260 horsepower motors.⁴ Although none of the observation airplanes used on the western front up to the conclusion of hostilities gave all-around satisfaction, the Salmsons were an improvement over the earlier ones in every respect-- they were sounder in construction, faster, and more maneuverable.

The Baccarat Sector was a typical "stabilized" or "quiet" front-line area. The enemy was strongly entrenched in positions which

²"History of the 12th Aero Squadron," 1918, E, Ily AS AEF, Vol. 3, pp. 124-125.

³Ibid., pp. 126-129.

⁴Ibid., p. 123.

had been in existence for many months. Barbed wire entanglements and machine gun strong points reinforced the lines of trench works. To the rear the infantry was supported by the usual complement of field and heavy artillery. In the air the German forces were considerably more numerous than was the case in the Toul Sector. A rather active observation air service was supplemented by a pursuit force which carried out daily patrols over the Sector. Although the enemy pursuit units were not equipped with the latest types of aircraft, these patrols were active and aggressive. On practically all clear nights, German bombardment squadrons operated against Allied airdromes, command posts, and the towns and villages adjoining the lines. Further to the rear, the enemy had a sizable force of pursuit aviation which devoted its energies to the attack of Allied bombardment squadrons which were then carrying out long distance raids into German throughout that area.⁵

The American 42d Division (to which the 12th Squadron was assigned) occupied the front from Badonvillers to Domevre, a distance of about seven miles. As in the Toul Sector, the American infantry positions were strongly fortified by trench systems, barbed wire entanglements and machine gun emplacements. These defenses were reinforced by two regiments of field artillery and one regiment of heavy artillery. The 42d Division operated under the command of the VI Corps of the French Eighth Army. All aviation forces in the Baccarat Sector operating for the VI Corps, French Eighth Army, were commanded

⁵ Intelligence Summary, May 29 to June 14, 1918, Headquarters 42d Division, American Expeditionary Forces, Baccarat, Meurthe-et-Moselle, France, June 14, 1918, in Department of the Army, United States Army in the World War, 1917-1919, III, 708.

by the Commandant de la Secteur Aéronautique, whose headquarters was located at Lunéville.⁶ This officer corresponded to the American Air Service's Corps Chief of Air Service which was developed later.

In addition to the 12th Aero Squadron the aviation forces of the Baccarat Sector consisted for the most part of French observation squadrons operating in conjunction with the divisions to the right and to the left of the 42d Division. These squadrons carried out for their divisions observation operations of the same nature as those to be performed for the 42d Division. In addition there was one French corps squadron which reported directly to the VI Corps headquarters. No regularly assigned Allied pursuit units patrolled that section of the front; consequently, observation planes had to rely solely upon their armament to defend themselves against hostile aircraft.⁷

The missions assigned to the 12th Aero Squadron in the Baccarat Sector were visual and photographic reconnaissance and surveillance of the enemy; adjustment of artillery fire; cooperation with the infantry when situations arose requiring infantry contact patrols to locate the front lines; and training missions with the infantry and artillery. The Squadron was also expected to coordinate and complete the training of its flying and ground personnel under actual war conditions.⁸

The flights over the lines were distributed according to a roster of flying personnel, with exceptions made occasionally in cases

⁶"History of the 12th Aero Squadron," 1918, E, Hy AS AEF, Vol. 3, p. 123.

⁷Ibid.

⁸Operations Order Number 2, Headquarters 42d Division, France, June 10, 1918, in ibid., pp. 182-184.

where certain pilots and observers were particularly well qualified for some special mission. In general the routine operations of the 12th Squadron were carried out in accordance with the methods developed in the Toul Sector. For the most part, the missions performed were confined to artillery adjustment and visual and photographic reconnaissance.

Infantry contact patrols were attempted on only one occasion: on June 24, 1918, during a German raid carried out against the American troops at the time of the relief of the 42d Division by the 77th Division. The raid took place during the night, and on the following morning the 12th Aero Squadron was requested to locate the friendly front lines. In attempting to carry out the request, the first plane dispatched returned badly damaged by anti-aircraft fire. The infantry failed repeatedly to respond to the signals of the second observer requesting them to mark out the front line by panels or bengal flares. The pilot of the second plane flew so low that the observer was able to distinguish the uniforms of the infantrymen and thus was able to get a rough idea as to the advanced positions. Unfortunately, this observer was wounded by machine gun fire from the ground before he had pinpointed the location of the front line troops. The third plane had no better fortune than had the first two in receiving a response from the infantry, but finally the observer was able to report the position of the troops based on his low-level observations.⁹

For the most part, aside from the visual reconnaissance

⁹Haslett, Luck on the Wing, pp. 55-60.

missions performed at dawn and twilight of each day, and a certain number of photographic missions requested by the 42d Division and the Commandant de la Secteur Aéronautique, practically all of the missions undertaken were planned by the squadron officers.¹⁰ Since the plan of aerial operations in the Baccarat Sector was primarily concerned with training, every effort was made to arrange and perform as many adjustments of artillery as possible. This was limited only by a shortage of artillery ammunition. Artillery batteries were allotted only a fixed number of shells for firing each day.¹¹

During the three weeks which the 12th Aero Squadron spent in the Baccarat Sector, a great deal of valuable advice was given to the observers by the Commandant de la Secteur Aéronautique, VI Corps, French Eighth Army, and visiting French and American observers experienced in combat operations. Considerable seasoning in aerial combat as well as in observation techniques was acquired as a result of attacks from German pursuit forces.¹²

Generally speaking, operations were a continuation and further development of those carried out previously in the Toul Sector. The visual and photographic reconnaissance missions, prearranged artillery fire adjustments, and infantry contact patrols were similar to the operations conducted in the Toul Sector. In a few instances visual reconnaissance missions were dispatched under orders from the

¹⁰Memorandum, Headquarters 42d Division, France, June 13, 1918, in "History of the 12th Aero Squadron," 1918, E, Hy AS AEF, Vol. 3, p. 178.

¹¹Ibid., pp. 152-154.

¹²Ibid., pp. 158-165.

Commandant de la Secteur Aéronautique of the French VI Corps to procure specific information about enemy positions, but on the whole reconnaissance missions covered the entire sector under orders to observe and report all enemy activity. During the 12th Squadron's tour of duty in the Baccarat Sector, little in the way of useful information was gained from general visual reconnaissances except when they were performed at dawn or just before darkness. Reconnaissance missions performed during daylight hours scarcely ever realized results sufficient to justify their dispatch and execution. Since the Baccarat Sector had been stabilized for so long and no offensives were under way, Allied and enemy activity was confined almost entirely to the hours of darkness.

Undoubtedly the most valuable lessons of the period at the Baccarat were those concerning the scope of personal liaison in the preparation for successful cooperation between aerial observation and ground troops. In addition, the experience derived in the execution of the exercises with artillery, although not of great proportion, was sufficient to acquaint the squadron observers with the general principles of this form of observation aviation, and to impress them with the importance of developing it in the future.¹³

From the point of view of the 12th Aero Squadron as a combat unit, the experience in the Baccarat Sector proved of value in that the organization was thrown entirely upon its own resources during the period of operations. The officers of the 12th Squadron acquired a seasoning which they probably would not have received had the Squadron been operating as one of several assigned to a group. This factor

¹³Haslett, Luck on the Wing, pp. 65-71.

proved of importance later, during the Air Service operations on the Marne when the need arose for a large number of observers trained in the principles of liaison with ground troops.

The 3d Flight of the 99th Squadron in the St. Dié Sector

Towards the middle of July, 1918, the American 5th Division, which was holding the line southwest of Colles and Frapelle in the St. Dié Sector in the Vosges Mountains, was ordered to advance and capture Frapelle, an important railhead and road junction. The 5th Division occupied a mountainous wooded area with defenses of the stabilized warfare type: trenches, barbed wire entanglements, dugouts, and carefully camouflaged artillery positions. Frapelle lay within a salient conforming to the course of a small creek which ran through a mountainous defile, and it was well defended by the Germans. The Allies planned to cut off the enemy salient and force the enemy to abandon Frapelle.¹⁴

The 3d Flight of the 99th Aero Squadron moved forward from Luxeuil-les-Bains to the airdrome at Dogneville near Epinal to replace Escadrille No. 285 and to assist the 5th Division. The 3d Flight was assigned to the French XXXIII Corps Observation Group of the French Seventh Army operating at Dogneville. To all intents and purposes the Flight was organized as a self-contained unit and it was administered along lines similar to those for French units in the Group.¹⁵

¹⁴"History of the 99th Aero Squadron, 1917-1925," 1925, p. 12, in USAF HD Archives.

¹⁵Ibid., p. 8.

The mission of the 3d Flight of the 99th Squadron according to the plan of attack was as follows: to photograph the enemy defenses prior to the attack; to ensure effective surveillance of enemy positions previous to and during the attack, carefully noting and reporting any indication of counteroffensive or local reactions in preparation; to adjust artillery fire on sensitive points within the enemy lines; to report the location of and adjust fire on enemy artillery batteries in action; and to photograph the positions at the close of the contemplated operation.¹⁶

Immediately upon their arrival at Dogneville on July 24, 1918, officers of the 3d Flight arranged for airplane cooperations with artillery and infantry units. Training exercises were carried out with the 9th and 10th Infantry Brigades of the 5th Division to assure cooperation from the line troops with the airplanes during infantry contact patrols. Telegraph, telephone, radio, and motorcycle courier communications were also established. The 3d Flight was equipped with seven Salmson airplanes.¹⁷

The missions flown by the 3d Flight of the 99th Aero Squadron, like practically every sort of aerial observation performed by the American Air Service in World War I, except for long-range photographic reconnaissance, required the airplane to fly low--lower, that is, than the levels of pursuit patrols. Observation teams, therefore, were invariably attacked from above. They were always in danger of attack,

¹⁶ Operations Order Number 23, Headquarters 5th Division, France, August 8, 1918, in "History of the 99th Aero Squadron," 1918, E, Hy AS AEF, Vol. 15, pp. 263-265.

¹⁷ Ibid., pp. 230-235.

and were almost always at an initial disadvantage, because the enemy would have seen them first and dived on them. This element of surprise accounted for the majority of victories in aerial battles; and since neither the observer nor his pilot was often justified in starting any action himself, they had to accustom themselves to many surprise attacks.

Technically speaking, the observer commanded the airplane. Until interrupted by the enemy, the pilot followed the observer's orders so that the observer could get precisely the information he had been sent for. If a fight started, the observer, who had two movable guns, was far more important as a combatant than the pilot, who generally had but one fixed gun. Of course, he could hardly give verbal orders to his pilot. To signal the approach of another airplane, he tapped the pilot's head and made a circular or a cross motion in the air, to identify it as a friend or an enemy. To change direction, the observer showed the desired direction by pointing. To command a sharp reverse of direction, he pulled the appropriate shoulder of the pilot.¹⁸

As soon as an enemy aircraft was sighted, the pilot and the observer had to decide instantly whether to fight or to run. The rule for observation machines was not to fight unless absolutely necessary, but if unavoidable, to engage the enemy, go at it hard and then when the battle was over, unless disabled, complete the mission. In case of any mechanical disability to the airplane, the pilot was promoted at once to command.¹⁹

¹⁸Haslett, Luck on the Wing, p. 125.

¹⁹Ibid.

In the majority of cases, enemy planes which attacked American observation craft were mono-place (one-seater) machines, limited to the use of fixed machine guns. These guns could fire in only one direction--the direction in which the ship itself was travelling. Unless the enemy disabled the observation ship or one of its two passengers during his dive he no longer had the advantage, except in his speed and maneuverability. In addition to a fixed gun or two operated by the pilot of the observation plane, there were the observer's two guns which could be fired in almost any direction. Therefore, a German chasse (pursuit) plane seldom attacked an Allied observation airplane without at least two colleagues to assist him. Occasionally they went after a single reconnaissance plane with an entire Jagdstaffel, or pursuit squadron.

The tactics employed by an observation team under attack depended to a great extent upon its mission. A ship on artillery réglage, for instance, was never more than a few miles from its own lines, and rarely more than 20 miles from its own airdrome; it could get home quickly and it could probably land safely even if slightly hit. Allied photographic machines were generally slow and wide open to attack, if they were flying low enough. The famous German Ace, Max Immelmann, gained the greater part of his reputation by his quick attacks and victories over ships of this class and not, as many suppose, over Allied chasse planes.²⁰ Eddie Rickenbacker tells at great length of his struggles on successive days to get at a big

²⁰Frederick Oughton, The Aces (New York: G. P. Putnam's Sons, 1960), pp. 35-36.

German Rumpler which was willing to take its pictures through a tele-photo lens at 22,000 feet rather than risk attack from a Nieuport, whose ceiling was only 19,000 feet. In this case there was really nothing to do; the Rumpler was always far out of effective machine gun range.²¹

Prior to the attack on Frapelle, planes of the 3d Flight successfully carried out artillery adjustments on enemy strong points. Photographic missions reconnoitered enemy territory to a depth of 25 miles, securing valuable photographs for American units. Enemy territory in the St. Dié Sector had never before been photographed deeper than 7 miles.²² Careful visual reconnaissances of the German forces were carried out at frequent intervals, and commanders were assured of the absence of any abnormal activity on the part of opposing forces.

At daybreak on August 17, 1918, following a heavy artillery barrage, the 9th Brigade began its assault on Frapelle. Two airplanes of the 3d Flight were over the lines when the attack began; one of these was on infantry contact duty and the other was charged with the detection and reporting of any enemy preparations for a counterattack. These planes were replaced at frequent intervals during the day until the successful completion of the operation.²³

²¹Rickenbacker, Fighting the Flying Circus, pp. 71-72 and pp. 144-145.

²²"History of the 99th Aero Squadron, 1917-1925," 1925, p. 11, in USAF HD Archives.

²³Report to the Chief of Staff, 5th Division from Chief Observer, 99th Aero Squadron Detachment, August 19, 1918, in ibid., pp. 13-14.

In spite of the training exercises which had been carried out, calls from infantry contact planes were consistently disregarded. The front line was never staked by panels. The approximate location of the friendly advance elements was, however, determined and reported to the command posts at frequent intervals. These patrols flew at altitudes low enough to permit identification of the uniforms of troops on the ground. In the course of these missions the planes were subjected to heavy machine gun and rifle fire from hostile forces. In several instances planes of the 3d Flight on infantry contact patrols fired on enemy machine gunners and scattered groups of German soldiers caught in the open and in roads.²⁴ Upon successful completion of the attack and establishment of a new front line, planes of the 3d Flight were dispatched and successfully photographed the front lines. Fortunately, the enemy aerial opposition in the Frapelle operation was negligible and the Americans were seldom hindered by hostile pursuit planes.

III Corps Air Service on the Vesle River

By the first week in August, 1918, the French Sixth Army had advanced to the Vesle River. The American III Corps (attached to the Sixth Army) held a portion of the front along the river extending approximately from Bazoches to Courlandon. The III Corps was organized with two divisions in the line and one in reserve. The usual complement of artillery which supported the forward divisions was

²⁴ Ibid.

augmented by a powerful concentration of 155 mm. heavy artillery. The mission of the Corps was to consolidate its positions on the south bank of the river, to exploit favorable opportunities for forcing passage of the Vesle, and to await a general advance by all Allied armies on the front.²⁵

In the air the Allies were comparatively weak. Although only one French pursuit unit, the 22d Pursuit Group, was available to patrol the entire front of the Sixth Army, Allied forces on the right and left of the III Corps had three or more observation squadrons each. The aerial observation units at the disposal of the III Corps were adequate for the demands of reconnaissance. All American squadrons were experienced.²⁶

Opposite the front of the III Corps the defense along the heights north of the Vesle was well organized. German infantry units were supported by heavy concentrations of artillery and machine guns. No immediate aggressive actions on the part of the enemy were foreseen; it was presumed that the Germans would confine their operations to purely defensive movements.²⁷

Dense concentrations of enemy pursuit squadrons opposite this sector furnished continuous patrol action from daylight to dark. The

²⁵ Preface to the Oisne-Aisne Operation August 7-November 11, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VI, 1.

²⁶ Patrol Report, III Corps, AEF, August 14, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VI, 87.

²⁷ "Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, pp. 2-3.

pilots of these flights were aggressive, experienced, and determined to prevent observation of German activity at all cost. Although the enemy completely dominated the air, his observation force was apparently inconsequential.²⁸

The III Corps Air Service was made up of the American 88th Aero Squadron flying Salmson aircraft; the French 284th Squadron equipped with Spads; and the French 237th Squadron with Bréguets. The units operated under the command of Major Kenneth P. Littauer, Chief of Air Service for the III Corps. No group commander or headquarters was assigned. The III Corps Chief of Air Service and his staff were stationed at the Ferme des Grèves airdrome. A French aviation officer had been assigned to assist him in directing the work of French units assigned to the III Corps Air Service.²⁹

The Ferme des Grèves airbase was situated on the heights overlooking the left bank of the Marne River, about six miles east of Château Thierry and roughly 20 miles behind the front lines. Preparations made for the American units by the French Sixth Army included tent hangars, which were adequate for housing the 38 planes of the three squadrons; huts and billets for the various headquarters offices and for quartering the squadron personnel; and bomb shelters in the form of abandoned trenches and dugouts constructed by troops who had recently fought over the ground. The airdrome had no defenses against

²⁸106th Report (Events from July 18 to August 7, 1918), Office of the Chief of Staff, German Supreme Headquarters, August 14, 1918, in Department of the Army, United States Army in the World War, 1917-1919, V, 676.

²⁹"Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, pp. 1, 5-7.

air raids other than the regional anti-aircraft artillery.³⁰

The mission assigned to the III Corps Air Service was to establish an effective surveillance of the enemy and report all of his activity, making certain the detection of either a retreat or an attack in preparation; to make a thorough photographic reconnaissance of enemy defenses opposite the front of the III Corps; to locate enemy batteries in action and assist reaction by Allied artillery; to inform the command of the location of advance elements during aggressive action (contact patrols); and to advance the training of infantry and artillery troops in the use of the aerial arm.³¹

The following assignments of squadrons and missions were directed by Major Littauer: to the 88th Squadron, artillery adjustments, sector reconnaissance, and contact patrols for the division on the right; to the 284th Squadron, artillery adjustments, divisional sector reconnaissance, and contact patrols for the division on the left; and to the 237th Squadron, the corps artillery adjustments.³²

Telephone communications connecting all Air Service units through a central switchboard were established at once. A direct telephone line was also strung from the Air Service headquarters to III Corps headquarters. An efficient system of personal liaison was developed. One observer from the 88th Squadron, stationed at the III Corps message center, kept in touch with the III Corps staff and

³⁰ Ibid., p. 4.

³¹ Operations Order Number 4, Headquarters, III Corps, August 4, 1918, in ibid., pp. 161-162.

³² Memorandum, Office of the III Corps Chief of Air Service, France, August 6, 1918, in ibid., p. 134.

informed the Air Service headquarters of the tactical situation and the needs of the front line units.³³ From time to time III Corps Air Service observers of the various squadrons were designated to visit and confer with the divisional and artillery staffs and unit commanders in the line.³⁴

All III Corps field orders, operations orders, plans of liaison, intelligence summaries, and other bulletins were sent to the office of the III Corps Chief of Air Service. Tactical and technical orders and bulletins emanating from the French Sixth Army Air Service were also forwarded to this office. In this way, a complete file of data was secured and kept up to date. Information directly affecting flying operations was posted conveniently in the operations room. Complete information on the tactical situation was thus maintained within easy reach of pilots and observers.³⁵

The III Corps Chief of Air Service prescribed that all requests for special observation missions should emanate from the G-2 (Intelligence) Section of the III Corps Staff. Orders originating in the divisions were communicated directly from divisional headquarters to the III Corps Chief of Air Service or his representative who directed their execution by the available squadrons. Prearranged missions were

³³"History of the 88th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, p. 117.

³⁴Memorandum, Office of the III Corps Chief of Air Service, France, August 27, 1918, in "Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, p. 141.

³⁵"Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, p. 23.

communicated to the operations officer of the III Corps Air Service on the day preceding their execution and were incorporated in the operations orders for the next day.³⁶

At the conclusion of each day's activity the operations officer of the III Corps Air Service received the reports of the operations officer of each squadron and prepared a consolidated operations report. This final report was transmitted daily to higher headquarters. On the basis of individual observers' reports the branch intelligence officer prepared nightly the III Corps Air Service intelligence report for the corps' and divisions' G-2 sections.³⁷

In addition to the usual method of reporting, observers of the III Corps Air Service returning from infantry contact and reconnaissance missions were required to report the results (whether positive or negative) of their missions by dropped message. Teams were instructed not to return to the airdrome at the close of a mission until messages had been dropped giving full and complete accounts of the observations effected.³⁸

No large-scale attack was projected or launched by troops of the Sixth Army. Operations consisted of harassing infantry and artillery assaults upon the enemy's positions to weaken his morale and wear down his strength and resources. Frequent short advances across

³⁶Memorandum, Office of the III Corps Chief of Air Service, France, August 20, 1918, in ibid., p. 137.

³⁷"Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, p. 26.

³⁸Ibid., p. 29.

the river were carried out, but the passage of the Vesle was not accomplished until the opening days of September.

During the first week in August, 1918, the III Corps Air Service began active operations along the Vesle River. Each day's work was carefully planned by the III Corps Chief of Air Service and his staff on the basis of the tactical situation as communicated by corps and divisional headquarters. The III Corps Air Service sought to detect any enemy preparations for attack or retreat. Morning and evening reconnaissances of the entire sector were established. As a rule, the divisional sectors were closely reconnoitered at least once daily by the divisional squadrons.³⁹ Unless otherwise advised by the III Corps Air Service, the French Sixth Army was assured that no untoward events were impending. Plans for the completion of Allied lines of defense and orders for the undertaking of any local aggressive operations could thus be issued with the confidence that most contingencies of German reaction had been foreseen.

The III Corps Air Service spared no effort to gather as much positive data as the situation permitted. Morning and evening reconnaissances were particularly effective in locating the flashes of enemy batteries in action. The 88th Squadron developed a ruse for trapping enemy guns into exposing their positions. The plane seeking to locate batteries first flew boldly up to the lines and remained at close range for some time, maintaining an altitude of about 2,000 feet. If, as was usually the case, enemy guns ceased fire in the presence of hostile observation and no battery flashes were observed, the plane retreated

³⁹Ibid., pp. 40-42.

about 6 miles into its own territory and dropped to an altitude of about 600 feet. After an interval it returned at this altitude to the lines. The observer, under these conditions, was able often to pick out two, three or more batteries which had resumed fire upon noting the absence of observation planes.⁴⁰

Vertical aerial photographs secured were a valuable source of positive information. During the six weeks spent by the III Corps Air Service on the Vesle the entire sector opposite the Allied front was photographed to a depth of seven and a half miles. These missions were carried out by formations of three or five planes at an average altitude of 9,000 feet. Many photographic flights failed because of the activities of enemy pursuit units which attacked in superior numbers. Although on one or two occasions close protection was secured from the neighboring French 22d Pursuit Group, pursuit protection was not ordinarily available because of the insufficient number of planes of the 22d Group. Delays encountered in meeting pursuit planes were responsible for the failure of missions which started in perfect weather but ran into fog or clouds before the rendezvous with the protection could be effected.⁴¹

A complete assortment of oblique views of the Vesle front was also secured. These photographs, remarkable for their clearness and sharpness of detail, were taken by the American photographic officers using 52 cm. cameras mounted on a support improvised on the observer's

⁴⁰"History of the 88th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, pp. 223-224.

⁴¹Ibid., pp. 236-237.

machine gun turret. They were of great value in familiarizing field commanders with the features of the enemy terrain immediately opposite the III Corps front.⁴²

From time to time, special missions were dispatched to reconnoiter the passages of the Vesle River. Planes detailed for these missions flew at low altitudes so the observers could note accurately the location and number of vehicular and foot bridges still intact. When crossings of the Vesle River were attempted, infantry contact planes were dispatched to stake the line of Allied troops. These missions met with little success. Troops appeared to be either ignorant of the use of panels in communicating their positions or too busy with the enemy at hand to respond to the observer's signals. In any case, panels were rarely shown and it was extremely difficult to distinguish individual soldiers in wooded terrain, even when observations were carried out at minimum altitudes.⁴³

To improve communication with the ground forces, the III Corps Chief of Air Service established an infantry contact school for the troops in the Vesle Sector. Training groups of 200 men each were drawn from the rifle companies, machine gun battalions, and headquarters detachments of each division and sent for three days to the airdrome at Ferme des Grèves. These groups brought with them sets of command post

⁴²Ibid., pp. 236-237.

⁴³"Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, pp. 55-56. The German aerial observers also reported a lack of infantry response in staking the front line. Report, German 236th Infantry Division, September 1, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VI, 318.

ground panels, signal rockets and pistols, bengal flares, and individual panels for each infantryman. Lectures were given on the use of airplane observation and the importance of determining the positions of advance units during an attack or retreat. Practical maneuvers were accomplished in which airplanes called for the line by rocket signals; it was staked out by troops using individual panels. The troops were instructed to spread the information acquired at the school and subsequent contact patrols were much more successful.⁴⁴

Ordinarily, the observer assigned to the prearranged artillery adjustment mission visited the battery on the day prior to the flight. Details of the shoot and the method of adjustment were agreed upon in advance by the observer, the battalion radio officer, and the battery commander. Even when careful preliminary liaison of this sort was undertaken, failure rather than success was the rule. The difficulty in most cases was traced to faulty radio communication. Artillery radio personnel were often inexpert and inexperienced and particular care was necessary to assure the proper functioning of radio equipment. Observers tested their radio equipment before leaving the field and wherever possible the Air Service radio station followed the calls of the plane. Radio operators at the airdrome kept an accurate log of calls sent by observation planes during the adjustments. These records indicated efficient functioning of the planes' equipment and failure of the battalion wireless station to receive effectively. To clear up these difficulties, trips were made by observers and radio personnel to artillery units and repeated panel exercises were conducted to train

⁴⁴"Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, pp. 61-68.

artillery radio personnel. Although better results were finally obtained, adjustments were never effected as successfully as was desired.⁴⁵

During the closing days of August the advance of the entire Allied line west of the French Sixth Army made it evident that the enemy's position on the heights overlooking the Vesle was threatened from the left flank and must soon be evacuated. A German retreat across the Aisne River was also considered imminent. Accordingly, the III Corps Air Service was instructed to report all indications of the expected withdrawal. As a result of their operations the observation units reported a noticeable increase and added aggressiveness of German pursuit aviation over the sector, a sudden decrease in enemy anti-aircraft and balloons opposite the front, and an increase of fires in villages and explosions of artillery dumps along the presumed line of withdrawal.⁴⁶ Observations of this nature became so frequent and convincing by September 1, 1918, that the III Corps Chief of Air Service reported that the German retreat was in full course.⁴⁷ Within two days the enemy evacuated the left half of the III Corps sector and retreated across the Aisne River. The United States 77th Division, which had been holding the left of the III Corps sector, crossed the

⁴⁵ Ibid., pp. 69-70.

⁴⁶ See the operations reports of the 77th Division for the latter part of August, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VI, 174, 176 ff.

⁴⁷ Operations Report, III Corps Air Service, September 1, 1918, in "Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, p. 152.

plateau between the Vesle and the Aisne without encountering resistance other than enemy harassing artillery fire.

In view of the expected enemy retreat, to be followed by a corresponding advance of Allied units, the III Corps Air Service made plans for a forward movement to assure close liaison. An airdrome with accommodations for one squadron was located at Goussancourt. The 88th Squadron and the headquarters of the III Corps Chief of Air Service prepared to advance, leaving the two French squadrons temporarily at Ferme des Grèves. It was thought that better results could be obtained by moving a squadron of 18 planes to the advance field. The comparative mobility of a single squadron assured its easy retreat in case of an enemy advance. About August 25, 1918, the office of the III Corps Chief of Air Service and the 88th Squadron moved to the advance field. Huts, hangars, and other accommodations were adequate. A direct telephone circuit to the Corps headquarters switchboard had been prepared, assuring communication with the line units and with the field at Ferme des Grèves. The move was planned so that no break in operations was involved. Half of the 88th Squadron flew to the advance field early in the day while the other half continued operations; the remaining planes were moved up later in the day while operations were resumed by those which had already arrived at Goussancourt.⁴⁸

In order to reduce liaison difficulties and to coordinate effectively the work of squadrons on separate fields, a routine scheme for the operations of the French 237th and 284th Squadrons was devised

⁴⁸"History of the 88th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, pp. 123-124.

and put into effect. These squadrons were made responsible for all surveillance of the III Corps sector and for reconnaissance of the left divisional front. Planes of the French squadrons returning from surveillance missions were required to drop reports of their missions at a dropping ground established adjacent to the office of the III Corps Chief of Air Service. This obviated landing, with its attendant dangers and difficulties, and at the same time these messages furnished an adequate check on the missions accomplished. The 88th Squadron continued to assure the accomplishment of corps missions, photographic reconnaissances, and missions for the right divisions. Heavy artillery adjustments were accomplished as usual by the 237th Squadron. Similarly, the 284th Squadron carried on the artillery work for the division on the left.⁴⁹ In general, the scheme of coordinating the observation operations from a rear and an advance field was successful.

During the second week of September, 1918, the III Corps was relieved and went to the Verdun Sector. The 88th Squadron was also relieved and proceeded for a period of rest to Ferme des Grèves.⁵⁰ The 237th and 284th Squadrons continued aerial observation missions for the units relieving the III Corps. On September 11, 1918, the 88th Squadron was temporarily attached to the American V Corps and was stationed at the Souilly airdrome in the Verdun Sector. No gas or oil was available at Souilly. The planes of the 88th Squadron had to operate over the

⁴⁹"Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, pp. 73-74.

⁵⁰"History of the 88th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, p. 125.

lines at St. Mihiel on the afternoon of September 12, 1918, with only the gas and oil remaining after the flight from Ferme des Grèves.⁵¹

The III Corps Air Service actively contributed to the conduct of operations on the Vesle. The information furnished was fairly complete and accurate, and by and large, the Air Service proved a successful means of liaison between the command and advancing troops. Ignorance in the use of signals and panels was the greatest cause of failure in most of the early operations, but the school established at the airdrome cleared up many of these difficulties. Cooperation between the Air Service and artillery units, however, was unsatisfactory. Poor radio discipline was the principal cause of failure. The operations of the observation squadrons of the III Corps over the lines were carried out in the face of aggressive and numerically superior German aircraft. Pursuit protection for observation missions was practically nonexistent. The dependence of the observation units upon pursuit barrage was demonstrated in a most convincing manner when mission after mission was hindered or failed completely because of enemy aerial ascendancy. Observation planes were forced to carry out their missions at low altitudes, rarely venturing far into enemy lines.

⁵¹Ibid., p. 126.

CHAPTER X

OPERATIONS ON THE MARNE SALIENT: CHÂTEAU THIERRY

Introduction

In the spring of 1918, the Germans launched a series of offensives by which they hoped to win the war before the American Expeditionary Forces could take to the field in strength. The first of these drives thrust a deep salient into the Allied lines at the point of junction of the British and French armies and seriously threatened the important railroad center of Amiens. The lines in that vicinity had scarcely been stabilized when the Germans launched a second offensive farther north, driving a salient into the British lines along the Lys River in the vicinity of Armentières. The third German offensive, which began on May 26, 1918, resulted in a huge V-shaped salient stretching between Soissons and Reims, with the tip resting on the Marne River at Château Thierry. During the last week of June, the American I Corps took up defensive positions on the western side of the salient in a sector commencing at the village of Vaux, immediately to the west of Château Thierry, and extending northwest to Courchamps.

The Château Thierry campaign may be divided into two main actions: the first, an Allied defensive; the second, an Allied offensive. During the operations of the I Corps on the front there

were three phases: the first was marked by preparations for a renewed German attack; the second was the period of enemy offensive and successful Allied resistance; the third saw the execution of a determined and successful Allied offensive.

Observation

During the first week of July, Major Lewis H. Brereton, I Corps Chief of Air Service, established his headquarters at La Ferté-sous-Jouarre. The units under his command were the 1st Aero Squadron, the 12th Aero Squadron, French 1st Squadron (replaced by the American 88th Aero Squadron on July 6, 1918), and the 1st, 2d, and 4th Balloon Companies.¹ The three aero squadrons made up the I Corps Observation Group, which retained the same organization established in the Toul Sector in May.

The I Corps Chief of Air Service acted chiefly in an advisory capacity for the I Corps commander and staff. Since aviation was a comparatively new branch of the army, the Air Service had to bear in mind that few of the advisors to the high command were well acquainted with its possibilities and limitations. The relationship of the I Corps Chief of Air Service to the units of his command was both administrative and tactical. He prepared all general plans of action for the Air Service of the I Corps in accordance with the orders of the I Corps Commander and provided liaison between the units of his command and took

¹"History of the Organization and Functioning of the Office of the I Corps Air Service," 1918, N, Hy AS AEF, Vol. 23, p. 2.

all necessary steps to insure close cooperation with the line units. He provided for the replacement of matériel and personnel and reported any deficiencies in training of personnel to the proper authorities.²

The adjutant of the I Corps Air Service supervised the administration of the units which comprised the I Corps Air Service. It was the duty of the information officer to keep the I Corps Chief of Air Service and Air Service units supplied with the latest tactical and technical information, including maps, photographs, and tactical orders, technical and general information. He was also responsible for the consolidated intelligence report of the I Corps Air Service, which was published nightly. The operations officer directed and coordinated the operations of all I Corps Air Service units. He prepared and forwarded all orders concerning operations and supervised their execution. He also prepared the daily I Corps Air Service operations report. It was the duty of the liaison officer to establish and maintain a close personal liaison with the commanding officers, intelligence chiefs, and operations directors of the I Corps headquarters and all subordinate staffs. He had to inform himself on matters necessary to the conduct of operations, to study this information, and to transmit it to the operations departments of the group and squadrons. He also had to ascertain the amount of training acquired by the artillery and infantry units and make plans for any supplementary instruction to be carried out. It was his duty to arrange for all necessary telephone and radio communications between the I Corps Chief of Air Service,

²General Order Number 81, General Headquarters, AEF, France, May 29, 1918.

I Corps Observation Group headquarters, I Corps staff, and line command posts. It was his duty to arrange plans for artillery adjustments by airplanes, designation and use of certain batteries for fire on fugitive targets upon call from aerial observers, and exercises with the infantry to increase proficiency in ground troop cooperation with contact patrol airplanes.³

The plan of communications drawn up for the I Corps Air Service was as follows: direct telephone communication with the I Corps Observation Group, observation squadrons, and higher headquarters; radio communication with all line units; personal liaison through visits made by the I Corps Chief of Air Service and his staff, corps headquarters and all corps units; and motorcycle courier service.⁴

The I Corps Observation Group was organized along the lines that had been followed in its original organization at the Ourches airdrome. During the last week of June, orders were received from the I Corps Observation Group headquarters, and the 1st and 12th Aero Squadrons proceeded to the Marne Sector. This move began on June 28, 1918, and by noon of the following day all the airplanes of both squadrons had been flown from Ourches and Vathemenil airdromes to the new field at Saints, three miles south of Coulommiers. Advance parties from each squadron arrived by automobile and completed the arrangements for quarters. By the evening of June 29, most of the I Corps Observation Group's men and equipment had arrived at the new base and it

³"History of the Organization and Functioning of the Office of the I Corps Air Service," 1918, N, Hy AS AEF, Vol. 23, pp. 2-3.

⁴"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 28-30.

was ready to begin operations. One French squadron, temporarily assigned to the Group, was already installed at the airdrome.⁵

The landing strip was situated on a large, level wheat field which had recently been harvested. Large canvas hangars had been erected and camouflaged by the French. The enlisted men were quartered in a group of farm buildings which bordered the flying field, and the commissioned personnel were billeted in the nearby villages of Saints and Maupertuis.⁶

The sector of the front to be patrolled by the I Corps Observation Group extended from Château Thierry to Courchamps, a distance of about 10 miles.⁷ The distance from the airfield to the front lines varied from 25 to 30 miles. The location of the airplanes at such a great distance from the front lines was a tactical necessity, dictated by the impending enemy offensive in the direction of Paris.

Two divisions were assigned to the American I Corps: the 2d Division, which was deployed on a sector which extended from a short distance west of Château Thierry to Torcy; and the French 167th Division, which occupied the front from Torcy north to Courchamps. The front lines consisted of shallow, hastily constructed trenches strengthened by barbed wire entanglements and machine gun emplacements. These front-line defenses were supported by the usual complement of

⁵Burdette S. Wright, "Notes on Observation Work at Château Thierry Campaign, July 2-August 12, 1918," December 17, 1918, C, Hy AS AEF, Vol. 2, p. 23.

⁶"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 26.

⁷"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 7.

artillery (two regiments of 75 mm. and one of 155 mm.), and in addition there were several reserve batteries of light artillery.⁸

The German ground troops were deployed in a manner similar to that of the Allied forces opposing them. The enemy front lines consisted for the most part of a series of strong points organized for machine gun defense. Shallow trenches, foxholes, and organized shell craters completed the lines between strong points. Behind the infantry positions was a large force of field artillery, and further to the rear the enemy had massed a formidable array of heavy artillery which executed the artillery preparation for the German offensive of July 15, 1918. Along the entire sector the enemy had a remarkably well-organized anti-aircraft defense consisting of machine guns and artillery.⁹

At Château Thierry the enemy had a powerful aggregation of pursuit squadrons and many units which carried out reconnaissance and bombardment operations. It became a daily occurrence for observation squadrons of the I Corps Group to encounter enemy patrols of from 7 to 20 planes. These hostile pursuit forces were well trained and were equipped with the latest types of Fokker D 7 fast scout planes.¹⁰

On June 30, 1918, the pilots and observers of the 1st and 12th Aero Squadrons carried out a number of short flights over the front

⁸War Department, Order of Battle, I, 199-201.

⁹German Order of Battle, July 15, 1918, Department of the Army, United States Army in the World War, 1917-1919, V, 174.

¹⁰"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 7.

lines to orient and accustom themselves to the new sector.¹¹ On the following afternoon, July 1, the American 2d Division launched an attack against the German-held village of Vaux. Observation planes from both the 1st and 12th Squadrons were in the air performing infantry contact patrols. Others executed surveillance missions for both infantry and artillery command posts. All other available pilots and observers were sent out as auxiliary surveillance teams to assure Allied dominance of the air. It was also expected that these teams might derive worthwhile experience in first-hand participation in this attack. The operations of this and the previous days were conducted as a matter of emergency, before comprehensive plans had been drafted assigning missions with various ground units to specific aero squadrons.¹²

During the next few days, the 1st and 12th Squadrons completed their interior organization, established their supply lines, received a number of new airplanes, and in general prepared for full-scale operations in the new sector. A considerable amount of personal liaison was carried out by the observers and operations officers in order to make final arrangements and to secure necessary data and information. Aerial activity included visual reconnaissances executed daily at dawn and twilight, numerous flights to orient flying personnel thoroughly to the sector, and several photographic missions over enemy positions. A few artillery adjustments were accomplished before July 5, when the

¹¹"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 32.

¹²Burdette S. Wright, "Notes on Observation Work at Château Thierry Campaign, July 2-August 12, 1918," December 17, 1918, C, Hy AS AEF, Vol. 2, p. 23.

26th Division relieved the 2d.¹³ On the same day, July 5, the I Corps Observation Group moved to the airfield at Francheville, a small village northwest of Coulommiers.¹⁴ The French 1st Squadron was relieved on the following day by the American 88th Aero Squadron which moved overland from Ourches.¹⁵ Operations of the I Corps Air Service as a complete organization began on July 7, 1918.

The missions assigned to the I Corps Air Service were to apprise the I Corps staff of the situation within the enemy lines to a depth of five miles opposite the Allied front; to adjust artillery fire; and to hold itself in readiness to perform infantry contact patrols. If the situation permitted, it was to furnish further training of ground troops in the use of observation airplanes.¹⁶

The following division of assignments was made: to the 1st Aero Squadron, adjustment of heavy artillery fire, surveillance of hostile artillery and location of enemy batteries, and visual reconnaissances of the corps sector; to the 12th Aero Squadron, all missions of the American 26th Division; and to the 88th Aero Squadron, all missions of the French 167th Division. A divisional squadron adjusted divisional artillery fire, performed visual reconnaissance of the

¹³"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 7.

¹⁴"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 34.

¹⁵"History of the 88th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, p. 132.

¹⁶"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 35-36.

divisional sector, and conducted divisional infantry contact patrols. The 1st and 12th Squadrons, equipped with Salmsons, performed the photography missions. The 88th Squadron flew British-built Sopwith airplanes, which were not well suited for mounting the large cameras used in aerial photography. The patterns for carrying out the day's routine remained essentially the same as the system developed in the Toul Sector. Due to the intensive nature of the work to be performed, however, the practice of assigning flights to "duty," "alert," and "off duty" was abandoned.¹⁷

From July 7 to July 15, 1918, the aerial observation operations undertaken were designed to keep the I Corps and its divisional staffs informed as to the tactical situation and developments in the enemy territory. Thorough visual reconnaissances took place daily at dawn and twilight to regulate the fire of the artillery against enemy sensitive points not visible from balloons and terrestrial observatories. Other visual reconnaissance missions were dispatched throughout the day as the tactical situation warranted. All such missions were much more definite in scope than were the daily reconnaissance missions in the Toul Sector. The observers' attention was directed particularly to the location of the enemy's battery positions, the movement on roads and railways, the location of any evidence of new works, trenches, stores, munitions, and troop movements.¹⁸

¹⁷ Burdette S. Wright, "Notes on Observation Work at Château Thierry Campaign, July 2-August 12, 1918," December 17, 1918, C, Hy AS AEF, Vol. 2, p. 23.

¹⁸ "Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 7.

Since the airfield at Francheville was so far from the front lines, an advanced base at Morass Farm, a few miles east of La Ferté-sous-Jouarre, was established. Two airplanes from each squadron flew to this field soon after daylight on days when the weather permitted aerial operations. Spare parts and other necessary supplies were stockpiled, a radio station established, and telephone lines were connected with the I Corps Chief of Air Service and I Corps headquarters. The observation teams stationed daily at Morass Farm stood ready to perform all types of missions except photography flights.¹⁹

With the exception of the attack on Vaux on July 1, no enemy or Allied actions requiring infantry contact patrols took place on this part of the front before July 15, 1918. A few training exercises were held behind the lines to instruct the infantry in marking out the line.²⁰

The unstable nature of the front made it imperative that frequent photographs of the enemy front-line positions be secured. As often as the weather permitted, the 1st and 12th Aero Squadrons made flights of this type. Great difficulty was experienced in carrying out these missions due to frequent and persistent attacks of hostile pursuit patrols. Attempts were made to use accompanying pursuit patrols as protection, but these were seldom completely successful. The low-speed, low-altitude protection assignments placed pursuit pilots at a great disadvantage during enemy attacks. Unless they left

¹⁹"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 40.

²⁰"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 7.

the formation, their aircraft were practically at the mercy of hostile pursuit patrols attacking from above. In event of attack, they immediately ceased to be of value as direct protection for the observation teams occupied with taking photographs. Observation teams often found it difficult to rendezvous with friendly pursuit forces before proceeding to the lines. The result was an eventual adoption of the policy of sending a number of observation airplanes out on each photographic mission; the lead plane of the formation was equipped with a camera and the others acted as bi-place (two-seated aircraft) protection. Due to the confidence inspired by the presence of pursuit escorts during photographic missions, pursuit protection was not entirely abandoned, and as frequently as possible arrangements were made to have escorts accompany the photographic plane.²¹

Nightly meetings were held in the G-2 (intelligence) section of the I Corps headquarters to discuss the developments of the day, new intelligence concerning the general situation, and new plans, or changes in existing plans. The I Corps Air Service was represented at these meetings by the I Corps Chief of Air Service or a member of his staff, by the I Corps Observation Group intelligence officer, and as often as possible by the group and squadron commanders. Enemy positions to be photographed and instructions as to the particular information to be noted by observers during the next day's visual reconnaissance missions were assigned at these meetings.²²

²¹ Ibid., p. 8.

²² "History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 46.

A few prearranged fire adjustments were carried out for the artillery batteries. The regulation of artillery fire on supply dumps, cross roads, and entrenched positions was about all that was attempted. Aerial spotting of artillery fire was quite limited because of the small amount of training in such work given the artillery units before they took their positions. Artillery units were often untrained in the proper choice of locations for the display of signal panels and in panel manipulation. Consequently, observers encountered great difficulty in locating and reading the ground signals necessary for proper execution of adjustments. Artillery radio crews possessed little or no experience in receiving and transmitting wireless messages. In one instance, men assigned to listen for radio calls for fugitive target firings had been put on kitchen police. The sergeant responsible for this felt that the men would have just wasted their time since the airplanes called them only once every two or three days.²³ Due to the distance which separated squadrons from artillery command posts, the rapid communications usually employed in a stabilized sector were not available. As a result a great deal of time was lost, many failures went uncorrected, and many misunderstandings arose. The I Corps Air Service attempted to improve its operations with the artillery through personal liaison, but with the squadrons so far removed from the artillery positions it was impossible to instruct the artillery in cooperation with aviation. Often the artillery was so occupied in routine operations, and in perfecting its preparations to defend the sector in the event of a renewed large-scale enemy offensive,

²³Haslett, Luck on the Wing, p. 112.

that it was virtually impossible to devote sufficient attention to training.

On the part of the Air Service, failures in attempted artillery adjustments arose on account of persistent attacks made by hostile patrols; others were due to the impossibility of notifying the artillery posts in cases where airplanes could not be dispatched at the prearranged hour, either because of equipment failures or unfavorable weather. Many of the replacement airplanes had not been inspected and it was often necessary to overhaul these planes completely before permitting them to fly over the lines. Other machines were totally lacking in radio equipment. Only a few of the adjustment failures which occurred were the fault of insufficiently trained observers. Flying officers designated for artillery missions were well fitted for their assignments, both in respect to training and through experience with French squadrons in operations over the front.

During the first two weeks of operations in the Château Thierry Sector, it became increasingly apparent that great efforts would be required from the Air Service to guard against failures likely to result from the insufficient training of ground troops in the proper use of aerial observation. As a consequence, an intensive system of personal liaison was inaugurated between the I Corps Air Service squadrons and the command posts of the line organizations. As an initial effort in this direction, an experienced observer was detailed from each of the squadrons to be stationed at the headquarters of the divisions to which the squadrons were assigned for operations. It was the duty of these liaison officers to investigate matters connected

with the proposed operations and to forward information necessary for Air Service cooperation in such operations. In addition, the liaison officer from the office of the I Corps Chief of Air Service made daily visits to I Corps headquarters, to the command posts, and to the headquarters of each division. There he interviewed the responsible officers concerning operations for the ensuing day. As it became more difficult to send messages between the divisions and the group, the custom developed of sending one officer from every squadron to the division and the command posts each day for the purpose of returning with new information, plans, and requests for missions. The inauguration of this personal liaison system improved the cooperation of the Air Service units with the line organizations, but it could not surmount the difficulties raised by insufficient training.²⁴

The main value of the operations of the I Corps Air Service on the Marne before the opening of the German offensive on July 15 lay in the information concerning the activities of the enemy obtained by visual and photographic reconnaissance. The results accomplished in the regulation of artillery fire were of comparatively little value. On the other hand, the experience gained by the members of the staff of the I Corps Air Service during these operations was invaluable; it gave them a basis upon which to plan future operations in this sector.

During this early period, mechanics of the 1st and 12th Squadrons became accustomed to repairing Salmson airplanes, and pilots and observers of all three squadrons became thoroughly oriented to the

²⁴"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 47-48.

new sector. Frequent combats during missions over the lines prepared the flying personnel to carry out their missions relying mainly on their own guns and flying skill. Plans to insure the personal liaison necessary for success in future aerial operations were developed. The experience of this preliminary phase showed that in an active zone of combat, little confidence could be placed on the telephone as a means of communication.

The second phase of the Marne campaign extended from July 15 to July 18, 1918. During these three days the last German offensive was launched, spent its full force, and was completely checked by the Allied defense. The plan of employment drawn up for the I Corps Air Service outlined procedures for coping with whatever tactical situations might arise and for an orderly withdrawal from Francheville to an air-drome further to the rear.²⁵ Throughout the enemy offensive, surveillance planes operating for the infantry and artillery were in the air during the daylight hours. Infantry contact patrols for marking the line were not necessary in the I Corps sector. The duration of the entire enemy offensive was so short that no real tactical problems developed.

Late in the afternoon of July 17, plans for the Allied counter-offensive scheduled to open the following day were received at the I Corps Observation Group headquarters.²⁶ The Air Service contacted all corps and divisional command posts immediately and arranged to conduct

²⁵ Ibid., p. 50.

²⁶ Field Order Number 9, Headquarters I Corps, July 17, 1918, Department of the Army, United States Army in the World War, 1917-1919, V, 36.

infantry contact patrols at prescribed intervals during the next day. Continuous surveillance over the fronts during daylight was planned. The area of artillery fire was plotted on a special map, and copies of this map were prepared for the squadron observers. When an observer located an enemy battery in action he would then signal this information to the artillery and immediately place the target under fire. If in the course of further surveillance the observer noted that the artillery fire was not properly directed, he would transmit the necessary correction to the artillery battery. Certain batteries of each brigade were specifically designated to fire on fugitive targets.²⁷

The third and last phase of the Marne campaign began on the morning of July 18, 1918, with the opening of the Allied counter-offensive between Soissons and Château Thierry. Marshal Ferdinand Foch, the Allied Commander-in-Chief, had moved several American and French divisions by night to the vicinity of Soissons, the dormant northern flank of the enemy salient. To mislead German aerial observers, troops were sent during daylight hours in the direction of Reims to simulate reinforcements being rushed there and to divert attention from the concentrations being sent to the opposite flank.

Soon after the forces at Soissons began their assault of July 18, the Allied command needed to know whether the Germans were making a stand and holding their positions or whether they were retreating. Major Lewis Brereton, Chief of Air Service, I Corps, was ordered to

²⁷ Letter, "Air Service Plans with Reference to Field Order No. 9," from Chief of Air Service, I Army Corps to Commanding General, I Army Corps, in Department of the Army, United States Army in the World War, 1917-1919, V, 417.

find out what the Germans were doing. Major Brereton and his Chief of Operations, Captain Elmer Haslett, agreed that the losses would be too great to risk sending out a squadron of observation planes so they themselves flew over the German lines unescorted, with Major Brereton as pilot and Captain Haslett as observer.²⁸ They discovered that the Germans were in full retreat; the enemy defense in the Marne salient had collapsed.

Observation operations of the I Corps Air Service from July 18 until August 12, when the I Corps was relieved by the American III Corps and the I Corps Air Service was withdrawn from the sector, can most easily be seen by describing the activities undertaken from the point of view of each type of mission performed.

During the advance of the I Corps, the execution of frequent infantry contact patrols in order to inform the commands of the location of advancing infantry units became a matter of daily routine. There were two methods of requesting such missions. At first the division commander notified the I Corps Chief of Air Service during the previous day that he desired contact patrols to be performed at specific times on the following day. This custom had two serious disadvantages. In the first place, there were only certain circumstances during which an infantry contact patrol was likely to attain the desired results. Flights were best executed shortly after the first or later stages of an infantry attack when the troops were momentarily resting and were sufficiently free to devote their attention to what was going on in the air above them. At such times they would

²⁸ Haslett, Luck on the Wing, pp. 89-97.

more than likely see and recognize their infantry contact patrol plane and note its request for them to mark out a line. On the other hand, if they were in the midst of hotly contested combat, they had little time or inclination to give attention to the air and in all likelihood the signal of the infantry contact plane went unheeded. The second disadvantage lay in the fact that no commander can fully predict the tactical situation for the following day. Even when the front lines were already known to the commander and there was no need for execution of the prearranged infantry contact patrol, the unnotified infantry plane often proceeded with its task with all of the attending risks.

The second method of requesting infantry contact patrols was to send word directly to the squadron or through the office of the I Corps Chief of Air Service one or two hours beforehand. From most points of view this was the better method, but it depended solely on the available means for transmitting messages to the squadrons. Within a few days after the beginning of the Allied offensive, it became impossible to rely upon telephone, telegraph, or radio for communication between the command posts and the Air Service units. Consequently, the hours for the execution of infantry contact flights were perforce fixed the day before and these, together with all information as to the probable location of the infantry at such hours, were sent to the squadrons by the liaison officer who made a daily circuit of the command posts.²⁹

²⁹ Burdette S. Wright, "Notes on Observation Work at Château Thierry Campaign, July 2-August 12, 1918," December 17, 1918, C, Hy AS AEF, Vol. 2, p. 24.

The most serious difficulties encountered in the performance of infantry contact patrols resulted from the lack of training on the part of the infantry. Although both the 26th and the 42d Divisions (the latter relieved the 26th Division on July 25, 1918) had been given a limited amount of training in Air Service cooperation, it was not sufficient to insure uniform success in keeping the command informed as to the location of the infantry by the infantry airplane. In some cases infantry regiments were not equipped with the proper supply of infantry panels and flares for marking out the line. In one instance panels were not issued to the infantry division on the front because the officer in charge thought they might get dirty.³⁰ Less fastidious doughboys used these panels to clean their shoes and wipe grease from machinery. The result was that in the majority of infantry contact patrols the observer was forced to descend to anywhere from 1,000 to 200 feet, face the machine gun and rifle fire that invariably met him when flying at such altitudes, and locate the front line troops by distinguishing their uniforms. Infantry men often shot at all airplanes because they did not know one from another.³¹ Despite attempts to

³⁰Philip J. Roosevelt, "Air Service in the Château Thierry Campaign," 1918, C, Hy AS AEF, Vol. 1, p. 26.

³¹The familiar star insignia carried on all Air Service airplanes in the United States was never used in Europe. The Allied insignia consisted of concentric circles of red, white and blue; the British concord had the red in the center, the French had the blue, and the Americans had the white. Five Air Service planes bearing this marking were shot up one morning by American troops which had just come to the front and still supposed that the star insignia used in America was also used in France. Maj. Haslett reported innumerable conversations with American Expeditionary Forces officers who claimed never to have seen an American plane in flight. They were still looking for the wrong markings. Haslett, Luck on the Wing, pp. 102-106.

instruct infantry units in recognition of Allied aircraft and in marking the line, at no time during the Marne offensive did infantry contact flights readily accomplish their missions.

During the first two weeks of the offensive, troop movements were so rapid that it became impossible to photograph all the territory in the line of advance. Photographic missions were therefore directed to certain areas chosen by the I Corps staff. Although weather conditions frequently hampered these missions, many useful pictures were obtained. During this action, taking oblique views at low altitudes, varying from 1,000 to 2,000 feet, became customary; such photographs proved invaluable to the ground commanders in planning advances. Until this time, most photographs had been vertical shots.

Visual reconnaissance missions were carried out regularly at dawn and twilight each day. Other reconnaissance missions were dispatched whenever the tactical situation made it necessary to secure particular information about enemy activity. A good deal of visual reconnaissance was carried out by artillery surveillance planes during periods of inactivity on the part of the enemy artillery. The routine procedure was to signal all information to the appropriate command post by radio, later confirming it by dropped written messages.³²

During the opening days of the offensive the artillery surveillance planes met with considerable success in signalling their reports on the activity of hostile batteries in accordance with the plan made July 17. After the American artillery regiments began to

³²Burdette S. Wright, "Notes on Observation Work at Château Thierry Campaign, July 2-August 12, 1918," December 17, 1918, C, Hy AS AEF, Vol. 2, p. 25.

move forward, communications became increasingly difficult to maintain. Surveillance was about all that artillery planes were ever able to do during this period. After the first day of the offensive, the artillery regiments moved forward almost daily. The failure of all ordinary means of communication made it impossible to carry out scheduled adjustments, for it was seldom possible to transmit the location of the batteries before another move occurred. Once the artillery began to advance, it likewise became impossible to have regularly assigned batteries for the conduct of fire on fugitive targets. This system, so efficient in a stabilized sector when conditions permitted speedy transmission of messages from the line units to the aero squadrons, was a complete failure under circumstances like those during the Allied advance, with the airdromes 25 to 35 miles behind the front and with the artillery changing positions daily. The net result was that the aerial cooperation with the artillery was mainly that of an information agent.³³

The best substitute for the plan of July 17 was to signal the headquarters of the artillery by radio and transmit all information to this one station. The artillery commander then assigned whatever battery he had available for the delivery of fire. The serious drawback of this method was that the aerial observer was not able to signal correction for the fire if it proved inaccurate, for not knowing the location of the battery firing he could not judge the errors in relation to the battery-target line. His only recourse was to give corrections with reference to north, south, east, and west. In a few

³³Ibid.

instances the observer was successful in securing the fire of a battery on a fugitive target. For the most part, however, it was impossible to notify the observer of the location of batteries or battalions before his departure; attempts made by the observer to locate them while in the air were usually unavailing.³⁴

The great distance between the line organizations and the Air Service units together with the conditions which resulted from the rapid advance of the ground troops caused a complete breakdown in communications. After July 19 it was practically impossible to make a telephone connection between divisional headquarters and the observation squadrons. The same problem existed with the I Corps headquarters after it moved forward from La Ferté-sous-Jouarre to Buire. It was nearly always impossible to send messages rapidly by telegraph; from two to four hours were required to transmit messages from I Corps headquarters to the airfields, and still longer was required to send a message from the divisions to air units. Radio, the ideal means of communication for use in the war of movement, was never developed to such a point that it could be relied upon by the American Expeditionary Forces in World War I. Messages were successfully interchanged between I Corps Observation Group and some command posts from time to time, but for the most part, due to inadequately trained radio personnel and occasional shortages of equipment, little confidence could be placed in this means of communication.

It therefore became the duty of the liaison officer stationed

³⁴"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 51-52.

at the command posts of the divisions and the corps artillery, working in conjunction with other liaison officers who made daily trips from the squadrons to these command posts, to supply the I Corps Chief of Air Service and the I Corps Observation Group with the information which in ordinary circumstances would have been transmitted by telephone, telegraph, or radio. This system had obvious drawbacks, but it helped to establish a closer understanding on the part of line organizations as to the proper use and limitations of the Air Service. Many difficulties and misunderstandings which had arisen previously on account of failures to distribute properly the Air Service operations codes to both artillery and infantry were eliminated.

Until about July 23, American observation planes were able to fly over the lines with little opposition from enemy aircraft. About that time the brigade of British pursuit planes left this portion of the front, leaving the American observation planes with insufficient pursuit aviation. By this time the front lines had advanced so far from the fields of the American pursuit squadrons that their planes spent the greater part of their time in the air going to and from the lines. As a result there were many losses of American observation aircraft and airmen in this sector. Replacements of pilots and observers was slow and far from satisfactory, and difficulty was also experienced in procuring replacement planes. Consequently, it became increasingly difficult to carry out the assigned missions and it was not infrequent that from six to eight pilots and observers in each squadron executed the missions scheduled for the day. This sometimes necessitated two

or three missions per team in a single day.³⁵

On July 22, 1918, the 1st and 12th Aero Squadrons were moved from the airdrome at Francheville to the airbase at Morass Farm east of La Ferté-sous-Jouarre.³⁶ The 88th Aero Squadron, re-equipped with Salmson aircraft on July 20, continued operations from Francheville until July 25 when the French 167th Division was withdrawn from the sector and the 88th Squadron assigned to the III Corps.³⁷ The 26th Division was relieved by the 42d Division on that same day and the American sector was narrowed to a one-division front. Early in August the 42d was relieved by the American 4th Division. All subsequent observation and photographic missions in this sector were carried out by the 1st and 12th Aero Squadrons. Adjustment of artillery fire was given to a French squadron assigned to the I Corps Observation Group.

On August 2 the I Corps Observation Group moved to the airdrome at May-en-Multien, north of Meaux, and August 10 it removed to an old German airdrome at Coincy, southwest of Fère-en-Tardenois. Two days later the I Corps Air Service was relieved from duty in the sector and moved to Chailly-en-Brie, near Coullomiers, to await further orders.³⁸

³⁵The status of matériel and personnel section of the I Corps Air Service operations report for July 16, 1918, Department of the Army, United States Army in the World War, 1917-1919, V, 48-49.

³⁶"History of the 12th Aero Squadron," 1918, E, Hy AS AEF, Vol. 3, p. 172.

³⁷"Report on Operations, III Corps Air Service," 1918, C, Hy AS AEF, Vol. 13, p. 1.

³⁸Burdette S. Wright, "Notes on Observation Work at Château Thierry Campaign, July 2-August 12, 1918," December 17, 1918, C, Hy AS AEF, Vol. 2, p. 26.

The Allied counteroffensive at Château Thierry changed the role of the observation squadrons. In the war of movement it was more difficult for ground and air units to keep in touch. Contact patrols became more important, photography decreased in importance, and the regulation of artillery fire on enemy batteries became more and more difficult.

The campaign on the Marne River demonstrated the necessity of developing radio communications between command posts and flying units because in a rapid advance little reliance could be placed upon the telephone and telegraph. The method of distributing codes and assigning call letters and panel numbers produced a great deal of confusion, misunderstanding, and failure during the first few weeks of the operations on the Marne.

Probably the most valuable lesson of the entire campaign was the knowledge that neither the artillery nor the infantry had sufficient training or experience in the proper use and limitations of observation aviation. With this one exception, these American divisions were among the most thoroughly trained and experienced American Expeditionary Forces organizations in France. Recognition of their lack of proper instruction in the use of the Air Service forewarned observation units as to what to expect in the future so that they could devote a significant portion of their efforts to solving this problem.

Bombardment

There were no American bombardment units assigned to the Air

Service at Château Thierry, but American aero squadrons did participate in bombardment operations. When the Germans began their attack on the night of July 14-15, 1918, the Allies were still ignorant of precisely where the main blow would be struck. Colonel William Mitchell, who as Chief of the 1st Air Brigade (which existed only on paper) was in charge of American aviation at the front, talked the situation over with the French and decided that a reconnaissance mission was necessary. Colonel Mitchell took off on this mission alone just before daybreak on the morning of July 15. He first flew north but saw no unusual troop movements near Château Thierry. Then Mitchell turned east and flew up the Marne where all the bridges had been destroyed; at Dormans he saw five new pontoon bridges spanning the river and German troops pouring across the Marne.³⁹ The Germans were attacking from the head of the salient, the base of which was formed by Soissons on one side and Reims on the other.

Believing that the Germans could not be stopped by frontal attacks, Colonel Mitchell proposed that all available Allied aviation units attack the enemy's main supply base at Fère-en-Tardenois. Although the Germans, who had numerically superior air service, still had control of the air within their lines, it was hoped that if this target were struck by planes from both sides of the salient the raid would be successful.⁴⁰ Mitchell's plan was approved. The British were asked to send bombers, for the American Air Service had almost none

³⁹Levine, Mitchell, Pioneer of Air Power, pp. 120-121.

⁴⁰Mitchell, Memoirs of World War I, pp. 212-213.

and the French were busy in their own sector. The British obliged with three squadrons of DH 9's and two squadrons of pursuit, one of which was equipped with Sopwith Camels and the other with SE 5's. These British units, together with the four American squadrons of the 1st Pursuit Group, attacked Fère-en-Tardenois on July 16. The Germans, although taken by surprise, managed to assemble a large aerial force and to shoot down 12 of the British bombers. Allied pursuit pilots shot down more than this number of German planes with small loss to themselves.⁴¹ The largest number of Allied planes ever to operate together participated in this raid, the first combined air offensive action. It demonstrated the potential power of a numerically inferior air force. Further, it forced the Germans to hold back additional planes to guard their supply base instead of sending them over Allied lines.

Pursuit

The 1st Pursuit Group, made up of the 27th, 94th, 95th, and 147th Squadrons, began operations in the Marne Sector early in July, 1918, as a part of the French Sixth Army Air Service.⁴² It faced considerably different conditions than those encountered in the Toul Sector. The airdrome at Ormeaux, which the 1st Pursuit Group occupied, was twice as far from the front as the one it had left. Communication

⁴¹Ibid.

⁴²"History of the Organization, Development and Growth of the 1st Pursuit Group," 1918, C, Hy AS AEF, Vol. 9, p. 10.

by telephone was nearly impossible, since the lines were constantly jammed with calls; radio service was also poor. The Group commander, Major Bert M. Atkinson, had to depend almost entirely on reports from returning patrol leaders for front-line information. Enemy aerial and ground opposition was decidedly strong and aggressive.⁴³ Squadron formations cruising at three flight levels became the rule.

The mission assigned to the pursuit units was threefold: to enable Allied observation to operate freely, to interfere with enemy observation, and to inflict damage on the enemy. Occasionally the French Sixth Army called on the 1st Pursuit Group to perform special reconnaissance missions since there were no army reconnaissance units per se at Château Thierry.⁴⁴ Close protection of observation planes was not too successful, but it had a great morale value because observation planes escorted by pursuit were not as likely to be attacked as were unescorted planes. Close protection, however, was costly and could be afforded only when the support to morale justified the losses. The difference in speed between the pursuit and observation planes made it difficult for them to keep together. It was necessary to fly at the same low altitude at which observation machines operated, thus giving the enemy the advantage of altitude. This, together with the fact that

⁴³The Germans had superior numbers of pursuit planes at all times at Château Thierry. The French intelligence service estimated the odds at one period to be 4 to 1. "Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 8.

⁴⁴Letter, "Employment of American 1st Pursuit Group," from Chief of Staff, American Expeditionary Forces, to Commanding General, I Corps, June 25, 1918, in Department of the Army, United States Army in the World War, 1917-1919, V, 228.

the pursuit airplanes had to stay in formation, made them vulnerable to attack, since the pilot could shoot only to the front. The basic trouble was that the pursuit aircraft were built for the speed and maneuver of combat, not for protective work. Unfortunately, there were not enough Allied pursuit planes available to drive the enemy from the skies, which would have been a more effective way of protecting the observation planes.

In order to intercept enemy two-seater observation planes, it was necessary to cruise at altitudes of over 10,000 feet. The plane that had the higher altitude had the advantage. It was therefore necessary for patrols at intermediate heights to be covered by a flight above them for protection. When enemy aircraft were sighted the patrol was warned from above. American pilots carried the war into the enemy's territory; the majority of aerial combats took place well within the enemy's lines. There was very little ground strafing in the Château Thierry operation, although when a particularly good target presented itself and the French asked that it be strafed, it was done.⁴⁵

On July 11 the British 9th Air Brigade arrived at Ormeaux, and the 1st Pursuit Group moved to a small field near Saints. The move was made without interruption of operations.⁴⁶ On the morning of July 14, the 1st Pursuit Group furnished protection for a photographic mission which was bitterly attacked but returned with more than 25

⁴⁵"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 8.

⁴⁶Philip J. Roosevelt, "Air Service in the Château Thierry Campaign," 1918, C, Hy AS AEF, Vol. 1, p. 9.

excellent photographs indicating that the Germans would probably attack within 24 hours. While engaged in protecting this mission, First Lieutenant Quentin Roosevelt of the 27th Pursuit Squadron, son of former President of the United States Theodore Roosevelt, was shot down behind enemy lines.⁴⁷

For two weeks after the beginning of the attack on July 15, the 1st Pursuit Group worked almost continuously. During this time its pilots changed from Nieuport to Spad S7 aircraft. A short loss of time in the air resulted from the change to the new planes; while they were better than the old ones, they were more difficult to keep in commission and both pilots and mechanics had to get used to them.⁴⁸

When the Allied advance came to a halt, the 1st Pursuit Group was 45 miles from the front, and an advanced landing field for refueling had to be established at Coincy. Many planes were damaged while landing to refuel and the losses of the 1st Pursuit Group were heavy. Although replacement pilots were received they were inexperienced; instead of being broken in gradually they were immediately put into combat. After the departure of the British 9th Air Brigade on July 23 there were not enough pursuit planes in the Allied sector. Those that were left were based so far back that they spent much of their time flying to and from the lines, and consequently they accomplished little.⁴⁹

⁴⁷ Operations Order Number 36, 1st Pursuit Group, July 14, 1918, in Department of the Army, United States Army in the World War, 1917-1919, V, pp. 43-44.

⁴⁸ Philip J. Roosevelt, "Air Service in the Château Thierry Campaign," 1918, C, Hy AS AEF, Vol. 1, p. 10.

⁴⁹ Ibid., pp. 12-13.

Although the 1st Pursuit Group was under the French Sixth Army for tactical orders, Colonel William Mitchell as commander of the 1st Air Brigade was in command of all American aviation units at the front and he, too, gave orders to the 1st Pursuit Group. It was impossible for the Group to obey orders from both Colonel Mitchell and the French. At Château Thierry Mitchell began the unfortunate policy--which reached its peak in the handling of American Air Service units in the St. Mihiel and Meuse-Argonne operations--of harassing group commanders with telephone calls for information and orders all day long. It was never understood whether the 1st Air Brigade's function was tactical or administrative; evidently Mitchell considered it to be both.⁵⁰ On August 10 the 1st Pursuit Group was detached from the I Corps and assigned to the American First Army which was organized that same day.⁵¹

Balloons

The 1st, 2d, and 4th Balloon Companies were the only American balloon units on the front in July, 1918. The 2d Company received orders about the first of July to proceed to the Château Thierry Sector where it worked with the 1st Division until the Division was relieved from that sector. While the 1st Division was advancing to cut the

⁵⁰ "History of the Development of Air Service Command on the Front," 1918, C, Hy AS AEF, Vol. 1, pp. 2-7. Mitchell probably got his ideas of what an air brigade should be from the British 9th Brigade which was stationed near his headquarters in July. In a letter to his immediate superior, Brig. Gen. Benjamin D. Foulois, Mitchell outlined what he thought his authority was. Mitchell, Memoirs of World War I, pp. 228-231.

⁵¹ Headquarters, Chief of Air Service, First Army, "Report of Operations," August 9, 1918, C, Hy AS AEF, Vol. 2, p. 16.

Soissons-Château Thierry road, the 2d Company was obliged to prepare six different balloon beds and set up corresponding telephone connections during a period of 10 days.⁵² The 1st Balloon Company arrived in the area of the 2d Division about July 18. The 4th Company got into action before the Allied advance; it was assigned to the 3d Division until relieved in the latter part of August.⁵³

The balloons followed the front line infantry units at a distance of about three miles. They located targets, registered artillery fire, and forwarded general intelligence. One of the most important needs of divisional staff was reliable information as to the advance positions reached by Allied infantry; this was often disclosed accurately to balloon observers by grenade fighting. Aerial observation assignments were sometimes given to airplanes when balloons were out of position and could not identify the front lines or artillery targets.⁵⁴

The change to open warfare which occurred at Château Thierry modified somewhat the balloon observer's duties. During trench warfare, troop movements were ordinarily made only at night so that in daylight the observer's principal tasks were to report the location of enemy guns seen firing and to observe the results of Allied artillery fire. This was usually done over terrain which had become thoroughly

⁵² Charles Chandler, "Report of the Balloon Section, Air Service, AEF," December 31, 1918, I, 29, in USAF HD Archives.

⁵³ "Review of Balloon Activities, 1917-1918," 1918, O, Hy AS AEF, Vol. 6, p. 43.

⁵⁴ Marc A. Lagan, "History of Balloons, First Army," 1918, F, Hy AS AEF, Vol. 1, pp. 33-34.

familiar to the observer. In the warfare of movement, however, the observer had unfamiliar terrain, and troops and transportation were moved during daylight hours. Frequently the construction and destruction of temporary bridges could be seen.

Aerial attacks against balloons were much more persistent than they had been in the Toul Sector. Incendiary bullets fired from a circling German aircraft could easily ignite the hydrogen. One balloon observer parachuted to safety five times in a single day--three times after his balloon had begun to burn, and twice when still under attack by German planes.⁵⁵

Besides being attacked by planes, the balloons were sometimes subjected to fire from high explosive shells. During the Allied drive in August, 1918, when German batteries were active, it was necessary to spot them from the balloons in order to direct the counter-battery artillery fire. An American observer ascended for that purpose and located several batteries. He was attacked by enemy planes but refused to leave his post. Finally the Germans opened fire on the balloon with their field guns. The shells burst to the right of the balloon, rocking the basket. The observer ordered the balloon to a higher altitude and remained in the air performing his mission, although fired on continually by the German artillery.⁵⁶

During the Château Thierry offensive, eight balloons were burned and one damaged by enemy shellfire. Twelve descents were made

⁵⁵Mitchell, Memoirs of World War I, p. 226.

⁵⁶Marc A. Lagan, "History of Balloons, First Army," 1918, F, Hy AS AEF, Vol. 1, p. 112.

in parachutes but there were no casualties.⁵⁷ Considering the limited number of balloons engaged, the number of artillery adjustments completed and the amount of information gathered and transmitted was remarkable.

⁵⁷"Balloon Operations in Offensive Combat: Château Thierry, July and August, 1918," 1918, F, Hy AS AEF, Vol. 2, p. 356.

CHAPTER XI

OPERATIONS ON THE ST. MIHIEL SALIENT

Introduction

The plan to develop an American army near St. Mihiel when sufficient troops were available, and to reduce the German salient there as a preliminary to a more decisive operation in the same vicinity was proposed by General John J. Pershing, Commander-in-Chief of the American Expeditionary Forces. General Pétain agreed to this at their first conference shortly after the arrival of the American command in France. General Pershing constantly kept this plan in mind and early in 1918 the battle area near St. Mihiel was used to give front-line experience to American units and to acquaint them with the region in which they would later attack.

The succession of German drives in the spring of 1918 made it necessary to postpone the original plan, as all available troops were urgently needed at other places on the front. Consequently, although there were more than 1,200,000 American soldiers in France in July, the American combat units were widely distributed along the entire front, either serving in line with the French and British armies or undergoing training in rear areas.

After the American divisions had completed their part in the Château Thierry emergency and had assisted in the subsequent

counteroffensive which turned the tide in favor of the Allies, General Pershing, despite renewed opposition on the part of the Allies, again insisted upon their assembly into one force. The American First Army was organized on August 10, 1918,¹ and immediately started preparations for its first large offensive action: the reduction of the St. Mihiel salient. This was the first operation in World War I carried out by a complete American army under the separate and independent control of the American Commander-in-Chief.

The value of the St. Mihiel salient to Germany lay in the fact that it protected the strategic centers of Metz and the Briey iron basin; interrupted traffic on the main Paris-Nancy railroad; cut the Verdun-Toul railroad; and threatened the Allied territory in its vicinity, especially west of the Meuse. Its reduction was imperative before any great Allied offensive could be launched against the Briey and Metz region or northward between the Meuse River and the Argonne Forest toward the general area around Sedan.

The St. Mihiel campaign may be divided into two periods: the period of preparation, August 10-September 11; and the period of attack, September 12-16, 1918. Early in August, 1918, the situation of the front lines in the St. Mihiel sector from Port-sur-Seille to Châtillon-sous-les-Côtes was practically the same as it had been for the past three and a half years. American preparation for the St. Mihiel offensive began on August 10, 1918, and from then until the first week in September new units, supplies, and munitions were brought to the

¹General Order Number 120, General Headquarters, AEF, France, July 24, 1918.

front.

Preparations for the attack against the salient were well along when on August 30 Marshal Foch, the Allied Commander-in-Chief, suggested to General Pershing that the offensive be reduced greatly in scope, that most of the divisions be used for an attack about September 15 between Verdun and Reims and that in the new offensive some of the American divisions be assigned to operate under larger French commands.

General Pershing felt that the St. Mihiel offensive should be carried out as planned and definitely stated that the American divisions would fight in the future only as part of an independent American army. After a series of conferences with Marshal Foch it was finally agreed on September 2 that the St. Mihiel attack would be carried out, but that its objectives would be limited so that the American First Army could undertake another major offensive about ten days later on the front between the Meuse River and the Argonne Forest.²

This agreement put a great burden on the American Expeditionary Forces for under it the First Army was called upon to carry to a conclusion an important offensive at St. Mihiel which was scheduled to start on September 12, to concentrate an enormous force on the Meuse-Argonne front, and to initiate a still greater operation there, all within the brief space of two weeks. In other words, at the time the agreement was made with the Allied Commander-in-Chief, the Americans undertook the mission of launching within the next 23 days two great

²An account of this heated exchange between Pershing and Foch is found in Pershing, My Experiences in the World War, II, 243 ff.

offensives on battlefields 40 miles apart.

The imbalance in the American forces which had resulted from earlier Allied demands for infantry and machine gun troops was rectified by the French and British. The American First Army finally had about 250 French-built light tanks available, 150 of them manned by Americans. About 3,000 pieces of artillery (British and French) were used and approximately 3,300,000 rounds of artillery ammunition were brought into the area in preparation for the St. Mihiel campaign. More than 550,000 American and 110,000 French soldiers were involved in the offensive. General Pershing's force greatly outnumbered the Germans.³

The order of battle of the First Army at the beginning of the St. Mihiel offensive placed the American V Corps on the left of the line, with its left flank joining the French Second Army at Châtillon-sous-les-Côtes. On the right of the V Corps was the French II Colonial Corps, near the point of the salient; and on the south side of the salient were the United States IV and I Corps. The right flank of the First Army joined the French Eighth Army at Port-sur-Seille.⁴

The First Army Air Service, commanded by Colonel William Mitchell, was organized at La Ferté-sous-Jouarre and began to function August 10.⁵ On August 26 Colonel Mitchell moved his headquarters to Ligny-en-Barrois, in the vicinity of the St. Mihiel salient, where

³McEntee, Military History of the World War, p. 525.

⁴War Department, Order of Battle, I, pp. 99-107.

⁵General Order Number 120, General Headquarters, AEF, France, July 24, 1918.

plans were developed for the attack.⁶ On August 28, 1918, Lieutenant Colonel Thomas Milling was appointed Chief of Staff, First Army Air Service; Major Paul F. M. Armengaud, Chief of the French Mission attached to the American Air Service, was appointed Assistant Chief of Staff. Lieutenant Colonel Townsend F. Dodd supervised the Information Section; Major John A. Paegelow commanded the Balloon Section. These officers with their assistants formed Colonel Mitchell's staff during the St. Mihiel operations.⁷

By September, 1918, the American Expeditionary Forces Air Service was made up of one army observation squadron, seven corps observation squadrons, one day bombardment squadron (later supplemented by two others), and fourteen pursuit squadrons (the 17th and 148th Squadrons were serving with the British Expeditionary Force).⁸ In anticipation of the St. Mihiel offensive, the French placed an Air Division consisting of a large number of pursuit and day bombardment squadrons at the disposal of the Americans and under the command of Colonel Mitchell. This force was augmented by one other French pursuit group and one French army artillery flying group for the adjustment of long-range artillery fire.⁹ Eight night bombardment squadrons of the

⁶"Operations of First Army Air Service, August 10-November 11, 1918," 1918, C, Hy AS AEF, Vol. 3, p. 7.

⁷Ibid., pp. 7-8.

⁸Diagram of First Army Flying Squadrons at the Front, September 12, 1918, C, Hy AS AEF, Vol. 3, p. 449.

⁹Letter from John J. Pershing to Marshal Foch, dated August 15, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VIII, 12. See also letters from Foch to Pershing, August 24, 1918, and August 27, 1918, ibid., 32-33, 160.

British Royal Air Force were to cooperate with the American First Army Air Service whenever the tactical situation made such action expedient.¹⁰ This concentration of American, French, and British air forces consisted of 701 pursuit, 366 observation, 323 day bombardment, and 91 night bombardment airplanes, making a total of 1,481 machines. This was the largest aggregation of air forces to engage in a single operation on the western front during the entire war.¹¹

The concentration of these forces prior to the attack posed quite a problem. Any increase in aerial activity would be noted instantly by the Germans, since every airplane approaching the lines was tracked by both sight and sound. It was necessary, therefore for Allied aviation to prevent enemy reconnaissance of rear areas. There was also a great demand for photographs of the terrain to be covered in the attack.¹² This, too, caused an increase in the number of flights over the sector, as did the adjustment of Allied artillery fire on sensitive points in the enemy's lines. In addition, a propaganda-dropping campaign began on August 28 and continued until the end of the war.¹³

¹⁰Letter from Hugh Trenchard, Commander of the Independent Force, RAF, to John J. Pershing, Commander-in-Chief, AEF, dated September 9, 1918, *ibid.*, 58.

¹¹There were 30,000 officers and men to handle the planes which were deployed on 14 main flying fields. Mitchell, Memoirs of World War I, pp. 238-239.

¹²"Photography at St. Mihiel," 1918, C, Hy AS AEF, Vol. 3, p. 1.

¹³Propaganda leaflets were prepared under the supervision of the American Expeditionary Forces Director of Intelligence. The campaign actually reached its greatest intensity in the month immediately preceding the Armistice. Its purpose was to contribute to the general

On the morning of September 12, 1918, after a four-hour artillery bombardment, the Allies launched their attack on the St. Mihiel salient. Aerial reconnaissance had indicated that the salient was about to be evacuated by the Germans. Although the enemy was expecting an attack, he had hoped to retire before it occurred. The Allied assault came as a surprise, and the Germans, virtually

decline of German morale, to break the fighting spirit of enemy troops, and to bring about desertions. Self-preservation, good treatment of prisoners, and the inevitable defeat of Germany were the chief arguments. See copies of these pamphlets in Lawrence Stallings (ed.), The First World War: A Photographic History (New York: Simon and Schuster, 1935), p. 251.

Apparently the propaganda was effective. Prisoners in increasing numbers surrendered with leaflets in their hands or concealed on their person. Many of the German prisoners captured in October were convinced that the war was lost. German commanders tried to counteract the effect of the leaflets by paying the troops for turning them in, by punishing them for reading the leaflets, and by conducting lectures to offset the effect of the leaflets. Proclamations against the leaflets, including one by Hindenburg, were promulgated in increasing numbers in the enemy press. Letters of German officers named the leaflets as a principal factor in the lowering of morale. The American commanders reasoned that although the effects of the leaflets were uneven they did contribute substantially to an atmosphere of defeat which permeated the German Army at the time of the Armistice. Herbert Blankenhorn, "AEF, Air Service, and Propaganda Against the Enemy," 1918, M, Hy AS AEF, Vol. 8, pp. 16-18.

If this judgment was correct, the principal credit for success should go to the individual fliers who voluntarily accepted this auxiliary assignment, loaded their planes with leaflets, and while observing or regulating artillery fire, showered the Germans with propaganda. Of 5,000,000 copies of 18 original leaflets, more than 3,000,000 were dropped over the enemy lines by the American Air Service. In view of the fact that the Germans had proclaimed that they would shoot or hang any aviator caught carrying propaganda, the actions of these fliers were even more commendable. Britain subsequently forbade her pilots to carry propaganda, while the French paid a bonus to her fliers for every pack of leaflets thrown overboard. Early in October, Austria threatened hanging for captured pilots who carried propaganda. In spite of these threats American aviators continued to improvise and experiment with methods of broadcasting leaflets so they would fall individually and not tangle in their machines. One flier even invented a propaganda "bomb" which accurately distributed leaflets. Shortly before the Armistice the British rescinded their order against carrying leaflets. Ibid., pp. 19-20.

immobilized, were forced to interrupt their withdrawal and meet the attack as best they could. The main thrust was directed against the face of the salient between Richécourt and Fey-en-Haye, on a ten-mile front. The American First Army, made up of the 1st, 2d, 5th, 26th, 42d, 89th, and 90th Divisions, accompanied by the French 15th Division, took part in the attack and advanced to a point north of Thiaucourt, forcing the Germans to retire completely from the St. Mihiel salient and retreat to the Hindenburg Line.¹⁴

Since Allied armies were again attacking an enemy salient, Mitchell used his numerically superior air forces in much the same way he had successfully gambled with a smaller force in the Château Thierry campaign.¹⁵ One third of his almost 1,500 planes were committed to support of ground operations; the remaining force was divided into two brigades of about 500 planes each. Having gained control of the air, Mitchell's forces simultaneously attacked opposite flanks of the salient, bombing and machine gunning installations, communications, and German troops columns. This aerial "blitzkrieg," the first in history, did not involve massive formations. At no time during this brief campaign were more than a few squadrons operating together.¹⁶

¹⁴ Jacques A. Chambrun and Charles Marenches, The American Army in the European Conflict (New York: Harcourt, Brace, and Co., 1939), pp. 268-276.

¹⁵ For a summary of Mitchell's proposals for employing his aviation units see his memorandum to the Commanding General, First Army, dated August 20, 1918, as printed in Mitchell, Memoirs of World War I, pp. 235-237.

¹⁶ Morris and Kendall, Ceiling Unlimited, pp. 181-182.

Corps Observation

The Air Service organization for each corps operating under the American First Army was made up of one squadron for each division and one squadron for the corps. The II Colonial Corps Air Service consisted entirely of French squadrons, the 28th and 236th.¹⁷ An observation group made up of French and American squadrons was assigned to each corps. These units were component parts of the corps to which they were assigned and were under direct orders of the corps commanders.

The I Corps Observation Group, commanded by Major George Pusifer, Jr., was composed of the American 1st, 12th, and 50th Aero Squadrons and the French 208th and 214th Squadrons. The 1st Aero Squadron was assigned to the 2d Division and the 12th to the 5th Division; the 50th Squadron, recently arrived at the front and equipped with DH 4's with Liberty engines, was assigned to the 90th Division.¹⁸

The 8th, 90th, and 135th Squadrons and the French 218th Squadron formed the IV Corps Observation Group, commanded by Major Joseph McNarney. The 8th Squadron was assigned to the 1st Division, the 90th to the 42d Division and the 135th to the 89th Division. Two of these squadrons were equipped with DH 4's while the 90th Squadron had Salmsons.¹⁹

¹⁷Special Order Number 151, First Army, AEF, September 6, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VIII, 200.

¹⁸"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, pp. 62-65.

¹⁹"History of the IV Corps Observation Group," 1918, C, Hy AS AEF, Vol. 14, p. 2.

The V Corps Observation Group was made up of the 99th, 104th, and French 42d Squadrons under the command of Major Arthur R. Christie. All of this Group's squadrons had Salmson planes. Due to bad weather, the 104th Squadron pilots were not able to ferry all their planes to Souilly when the V Corps Observation Group moved there; some of the fliers shared 99th Squadron planes.²⁰ On September 15, too late to be in the offensive proper, the 88th Squadron, also equipped with Salmsons, arrived from the Vesle and was attached briefly to the V Corps Observation Group.²¹

The German lines on the front from St. Mihiel north to Châtillon-sous-les-Côtes were organized in approximately the same manner as on the Toul and Château Thierry Sectors. The German forces were favored by the terrain, which offered many natural positions of great strength; these positions had been well organized for a prolonged defense. Some intimation of an impending Allied offensive in this sector had reached the enemy, and immediately preceding the attack of September 12 he redistributed his forces. As far as was known at the time, enemy strength in the St. Mihiel sector remained about the same as it had been throughout the summer months.

In the air the strength of the enemy continued to be the same as it had been since the previous spring. A few pursuit patrols of Fokker airplanes were reported but it was quite probable that these

²⁰"History of the V Corps Air Service," 1918, C, Hy AS AEF, Vol. 14, pp. 13-14.

²¹"Organization and Functioning of the Office of the Chief of Air Service, Army Corps," 1918, C, Hy AS AEF, Vol. 12, pp. 2-17.

were new planes received as replacements for the Albatros and Pfalz aircraft formerly in use. Individual observation and photography planes sometimes flew over the lines, but no unusual number of hostile aircraft was reported before the opening of the St. Mihiel offensive.

Observation units for each First Army corps were organized along the same lines as those of the I and III Corps Air Services. In the I and IV Corps, the offices of the Corps Chief of Air Service were located at corps headquarters. In the V Corps Air Service, assembled for the first time, only one of the three squadrons had had any significant experience in active front-line operations; therefore, the Corps Chief of Air Service and his staff remained at the flying field.²²

The I Corps Observation Group was located on two airfields near Toul. The 1st, 12th, and 50th Squadrons were stationed at Dommartin-les-Toul, the airdrome east of Toul which had formerly been occupied by the 1st Pursuit Group in the spring of 1918. The French 208th and 214th Squadrons occupied a newly constructed airdrome at Biqueley, just south of Toul. The entire IV Corps Observation Group occupied the airdrome at Ourches. The French squadrons of the II Colonial Corps were located at Rumont, to the northeast of Bar-le-Duc. The V Corps Observation Group occupied a flying field at Souilly.²³

Major Lewis H. Brereton was appointed Wing Commander of Corps Observation for the First Army on August 28, 1918, and established his office at Toul on September 1. He and his staff were

²²"History of the V Corps Air Service," 1918, C, Hy AS AEF, Vol. 14, p. 14.

²³"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, p. 14.

charged with the instruction and inspection of all observation squadrons or observation groups assigned to army corps. He coordinates their duty and exercises technical supervision over all army corps aviation units. This includes the method by which duty is performed, the supply and proper care of matériel, the supply and instruction of personnel, the location of airdromes, the handling and care of transportation, the state of the telephonic, radio, and other signalling appliances, and methods, the photographic sections, the operations offices, the preparation and forwarding of orders, reports, and messages, the maintenance of liaison with contiguous troops, and the reporting to the Chief of Air Service of the Army any irregularities observed in methods of performing duty either tactical or technical.²⁴

The Wing Commander and his staff had been through the operations on the Marne with the I Corps, and their experience proved invaluable in preparing newly formed squadrons for the St. Mihiel offensive.

Profiting by the lessons learned on the Marne, they took measures to guard against recurrence of the conditions which had there hindered observation aviation. Preparations for the coming offensive were explained with great care and detail in bulletins prepared in the office of the Wing Commander and distributed to Air Service units of each corps.

The plans made by each corps Air Service in preparation for the St. Mihiel offensive were for the most part essentially the same as those made to meet the tactical situation at Château Thierry. The corps Air Service commanders assigned the squadrons of their groups to care for the corps and divisional needs. Under the direct guidance of the group commanders, officers of the groups and squadrons working in conjunction with the staffs of the corps chief of Air Service collected and compiled the data necessary for the coming operations. Particular

²⁴Letter from Chief of Air Service, First Army, to the Command, Corps Observation Wing, First Army, dated August 20, 1918, N, Ily AS AEF, Vol. 22, p. 48.

attention was given to the assignment of liaison officers from each group to the corps command posts and the headquarters of each division. In addition, the flying officers of the squadrons and the operations officers of the groups and squadrons made daily trips to the various command posts of the corps and divisional troops in order to insure a thorough understanding on the part of all line officers of the elements necessary to bring about successful cooperation between the corps Air Service and the corps ground troops. In the brief time at their disposal, they instructed the infantry and artillery in the details of infantry contact patrols and artillery fire adjustments.²⁵

The plan of communications between the office of the Wing Commander, the various corps Chiefs of Air Service, the corps observation groups, and the command posts of each corps was the same as that used at Château Thierry. In addition to the custom of assigning an experienced observer to artillery command posts and the headquarters of each division, an Air Service officer was also sent to the headquarters of the corps operating on either flank of the American First Army.²⁶

During the period of preparation, visual and photographic reconnaissance, artillery fire adjustment, and training exercises with artillery and infantry were carried out. Visual reconnaissance of the corps and divisional sectors was performed routinely at dawn and

²⁵ Plan of Employment of Air Service Units, Annex Number 3, Field Order Number 9, Headquarters, AEF, September 7, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VIII, 215-216.

²⁶ Plan of Liaison, Annex Number 4, Field Order Number 9, Headquarters, AEF, September 7, 1918, in ibid., pp. 218-219.

twilight of each day. A few special visual reconnaissance missions were dispatched to secure particular information. Visual reconnaissance was valuable only in that it kept the command informed of the situation in the German lines opposite each corps. Due to the inactivity of the enemy at this period most of the information secured in this manner was of a negative nature, but it assured the staff that there were no new developments in the general tactical situation. On photographic reconnaissance during the period of preparation, oblique views were taken of the enemy territory immediately opposite the front lines of each corps. This type of photography proved of great value in the preparation of detailed attack plans.²⁷

Due to the necessity of veiling all preparations for the offensive, there was little attempt to adjust artillery fire. Only a few rounds to register the fire of new batteries on certain points were spotted by aerial observers. Training exercises to prepare infantry and artillery units for cooperation with airplane observers were conducted as frequently as possible. All aerial operations conducted in preparation for the St. Mihiel offensive were limited by the unfavorable weather which prevailed during the early days of September.

On the morning of September 12, 1918, when the attack was launched, a heavy mist, low-lying cloud banks, and intermittent rain combined to make aerial observation extremely difficult. Notwithstanding this fact, infantry contact patrols and artillery surveillance planes performed their respective missions throughout the daylight

²⁷ Graphs of the Photographic and Visual Reconnaissance Made by the I Corps Observation Group, August 31 to September 16, 1918, in A, Hy AS AEF, Vol. 29, p. 12.

hours. Thus the command was kept informed of the general progress of the battle and at periodic intervals was given the location of advancing troops. Artillery planes were able to regulate artillery fire on fugitive targets only by taking advantage of momentary gaps in the clouds and mist, when they could observe and report the location of such targets. Aerial observation operations accomplished on the following day, September 13, were virtually a repetition of the previous day, for the same unfavorable weather conditions continued.²⁸

On September 14, the one day during the offensive which was favorable for the conduct of aerial operations, missions of every type were dispatched throughout the hours of daylight. Infantry contact patrols and visual reconnaissance missions kept the command well informed as to the progress of the attacking troops and of the situation within the German lines to a depth of five miles. Photographic missions produced a large number of useful photographs of the enemy's front line positions and some successful artillery adjustments were accomplished against fugitive targets located in the enemy lines.

Early on the morning of the 14th, there was a noticeable increase of hostile pursuit flights. Some of the best German fliers operated along the St. Mihiel sector and observation planes were repeatedly attacked. In the majority of cases, American observation teams successfully defended themselves and accomplished their assigned missions. On September 15, disagreeable weather again greatly hindered aerial operations; the accomplishments were similar to those during the

²⁸"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, pp. 16-20.

first two days of the offensive.²⁹

The short duration of the St. Mihiel offensive and the unfavorable weather which prevailed throughout three of the four days makes it difficult to draw conclusions about the observations done by American First Army Air Service units. The information provided to the various army, corps, and divisional staffs by the reconnaissance flights, artillery surveillance planes, and infantry contact patrols was of undoubted value. During the hours of daylight and whenever atmospheric conditions made movement on the ground visible, observation teams were in the air in numbers sufficient to follow movement of German and Allied troops. The information thus procured, except in a few instances, was speedily transmitted to advanced infantry and artillery command posts; it was first sent from the plane by radio and later was confirmed by written messages dropped at the appropriate command post.

As information agents the airplanes operating in cooperation with artillery units were not all that could be desired. There were several things which contributed to the lack of success in adjusting artillery fire on fugitive targets. Although some of the squadrons which took part in the St. Mihiel operation had had experience operating over quiet sectors, many squadrons were totally inexperienced and none of them had participated in large-scale offensive operations. As a consequence, some of the observers failed to report directly to artillery batteries the fugitive targets which they located during missions over the German lines. They noted the information and sent

²⁹Ibid., pp. 20-21.

it to the corps command posts but failed to realize that their first duty was to convey this intelligence to the proper artillery units where it could be given immediate attention. In a few instances when repeated radio calls to artillery command posts did not elicit a response, the observer then neglected to drop a written message. On the other hand, the artillery battalions, and in particular those assigned to fire on fugitive targets, repeatedly failed to respond to radio calls from the airplanes assigned to cooperate with them.³⁰

The same problems which had plagued air-to-ground contact at Château Thierry reappeared in the St. Mihiel offensive. In some cases the trouble was a matter of faulty installation, but the majority of failures could be traced to the insufficiently trained and inexperienced crews assigned to artillery communications stations. It was also found that dropped written messages were often lost because search crews at the panel stations failed to be alert for airplanes seeking to communicate with the command post. The Air Service was not always notified of changes made in the location of the batteries and battalion radio stations, and many failures of the artillery to respond to radio calls from the airplanes resulted. In one instance six adjustments had been prearranged for the next day; during the night all six batteries were moved and although the artillery knew that an Air Service liaison officer was on duty at division headquarters, the Air Service was not advised of the change in location of these units.³¹ In some

³⁰ Haslett, Luck on the Wing, pp. 113-114.

³¹ "History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 76.

cases where it was necessary to move batteries designated to fire on fugitive targets, commanders neglected to assign other batteries to replace them during their movement. Without better cooperation on the part of the artillery in forwarding information necessary for the conduct of operations to the Air Service, little success could have been expected.

During the greater part of the time in which the observation units had operated over the western front, the weather had been excellent for aerial operations. In the short spells of poor weather which had occurred during the late spring and summer, Air Service operations were seldom undertaken; occasionally, low clouds had forestalled photographic flights. At St. Mihiel for the first time missions were sent out almost irrespective of weather. Only a downpour or a thick fog was allowed to impede the conduct of operations. The flying personnel learned to carry out reconnaissance and infantry contact patrols at extremely low altitudes, trusting in occasional breaks in the clouds and mists to make the ground visible. Furthermore, they achieved considerable success in securing general information as to the positions of friendly infantry lines under such conditions. The knowledge that some success could be achieved in this manner was utilized in great measure during the operations conducted from that time on. Low-level infantry contact patrol and visual reconnaissance missions conducted even during unfavorable weather became an accepted pattern of aerial observation during the St. Mihiel offensive.

Army Observation

The First Army Observation Group, commanded by Major John W. Reynolds, was formed around the 91st Aero Squadron to which the 9th Night Reconnaissance and 24th Aero Squadrons were added. Due to the inexperience of the flying personnel, the 24th Squadron was unable to participate to any great extent. The 9th Squadron could not function at all because of lack of equipment and training. Four French squadrons regulated army artillery fire.³²

The operations order issued by the Chief of Air Service, First Army, on September 10, 1918, made the First Army Observation Group responsible for the reconnaissance of the enemy's back area opposite the entire sector of attack. The First Army General Staff was to be supplied with information concerning the disposition and movement of enemy forces, and the enemy sector was to be kept under constant surveillance. The Chief of Staff, First Army, submitted a map on which were indicated the various artillery objectives to be photographed on every day of the attack.³³

Beginning at daybreak, formations of three planes were scheduled to leave the airdrome at two hour intervals to reconnoiter the enemy's rear areas. Formations of at least three planes were necessary, as there was no pursuit protection available; pursuit escorts could not penetrate German lines to the depth that army

³²"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, p. 202.

³³"History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, pp. 12-14.

reconnaissance planes were required to go. It was almost certain that the army observation planes would be vigorously attacked by enemy aircraft.³⁴

Metz and Conflans were artillery objectives to be photographed; both points were far behind German lines and were especially well guarded by enemy pursuit planes. It was considered necessary to send as many protecting planes as possible with each photographic plane so that the mission could be accomplished in spite of enemy opposition.³⁵ Planes unfit for service over the lines were kept ready to carry messages between the airdromes and the First Army headquarters dropping ground located near Ligny-en-Barrois.³⁶

The attack began the morning of September 12 at five o'clock. At dawn heavy banks of dark rain clouds fanned by a strong southwest wind were racing across the sky. In spite of these adverse weather conditions, two planes left the airdrome shortly after daybreak to carry out visual reconnaissance. One plane found a rift in the clouds through which it descended and gathered valuable information; the other was less fortunate and returned to the airdrome after an

³⁴On the afternoon of September 7 three airplanes of the 91st Squadron on a photographic mission were attacked by five enemy machines who broke up the American formation, forcing one of the Air Service planes to land north of Conflans. Cablegram Number 116, from General Headquarters, American Expeditionary Forces to Washington, September 7, 1918, in Department of the Army, United States Army in the World War, 1917-1919, XIII, 315-316.

³⁵"Methods of Protecting Observation Aeroplanes," 1918, A, Hy AS AEF, Vol. 29, p. 10.

³⁶Field Order Number 9, First Army, AEF, September 7, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VIII, 206.

unsuccessful attempt to find an opening in the clouds and fog.³⁷

Because of the prevailing adverse weather conditions, schedules prepared the preceding day were disregarded, for the low clouds made formation flying impossible. Photography was out of the question. Single planes were dispatched whenever the weather permitted.

During the first day the enemy territory was successfully reconnoitered to a depth of from 35 to 50 miles. No missions were carried out at altitudes exceeding 3,000 feet. These flights were accomplished without the loss of a single plane or even a single casualty.³⁸ This success was due largely to the fact that during the months preceding the attack, the pilots and observers had gained a thorough knowledge of the entire sector, both through experience and because of extensive training given them during earlier operations. In spite of occasional heavy rainstorms, the excellent condition of the flying field occupied by the First Army Observation Group made it possible for planes to take off and land without breaking propellers.³⁹

Successful reconnoitering of German back areas became extremely difficult due to the rapid increase in number of enemy pursuit planes as the battle progressed. Nevertheless, the First Army Observation Group was able to furnish the First Army General Staff with complete and accurate information regarding movement and disposition of enemy forces.

September 14 was marked by a decided change in the weather; the sky was clear and visibility was excellent. Two airplanes from the

³⁷"History of the 91st Aero Squadron," 1918, E, Hy AS AEF, Vol. 10, pp. 75-76.

³⁸Ibid.

³⁹Patrick, Final Report, p. 11.

91st Aero Squadron were dispatched for the dawn reconnaissance. Later that morning several photography missions dispatched by the Group were only partially successful because each formation was repeatedly attacked by superior numbers of German pursuit planes. These planes attacked the American fliers with a determination and persistence never before encountered in this particular sector.⁴⁰ In the course of the afternoon several photographic missions were successfully accomplished in spite of enemy opposition.

The American Expeditionary Forces concluded their attack on the St. Mihiel salient on September 16, 1918. Reconnaissance flights were made throughout the day. Though there was a certain degree of enemy aerial opposition, no difficulty was experienced in carrying out any of the missions.⁴¹

During the next three days, missions were dispatched only for the purpose of keeping up a general light surveillance of the enemy sector. On September 20 orders were received directing the removal of the First Army Observation Group in accordance with the general plan of the transfer of the First Army to the sector west of Verdun. The Group's new airdrome was located at Vavincourt, Meuse. The advance echelon

⁴⁰The only German pursuit planes encountered in the St. Mihiel sector prior to September 1, 1918, were Pfalz and Albatros scouts. At the high altitudes at which the 91st Aero Squadron cruised, the Salmson plane had a decided speed advantage over these enemy planes, both in climbing and in level flight. The reinforcing enemy units were equipped with the Fokker D 7 scout plane, which had a considerable advantage in climbing speed over the Salmson. At high altitudes, however, the Salmson was much faster than the German aircraft. "History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, pp. 21-23.

⁴¹Ibid., pp. 25-28.

was sent out immediately upon receipt of the order, and by the 22d of September the move to the new station was completed.⁴²

Despite the prevailing inclement weather, which greatly hampered flying, the First Army General Staff was supplied with necessary information of the enemy during the reduction of the St. Mihiel salient. Only three planes were lost, two of them flown by inexperienced teams of the 24th Aero Squadron. Against this loss, the records show a total of five enemy planes destroyed by First Army Observation Group fliers during this campaign.⁴³

During the entire period of operations of the First Army Observation Group on the front there was a deficiency of intelligence forwarded to this command. The nature of the duties performed by this organization were such that it could work almost independently. If there had been closer relations among the various units within the First Army, better results might have been obtained. Throughout the St. Mihiel offensive, which lasted only a short time, the First Army Observation Group had little information regarding the progress of the ground troops or anything else that was taking place except the reports brought back by observers of their own organization.

Bombardment

The 1st Day Bombardment Group, composed of the 11th, 20th, and

⁴²"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, p. 226.

⁴³"History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, p. 25.

96th Squadrons and commanded by Major James L. Dunsworth, was formed two days before the St. Mihiel offensive opened. Some of the pilots of the first two squadrons had served with French units at the front but most of them were inexperienced. The two new squadrons were equipped with DH 4 airplanes with Liberty motors made in the United States; the 96th still flew Bréguets. The French made available a force of day and night bombardment planes and for the coming offensive the British Independent Air Force put a number of bomber squadrons at the disposal of the American First Army.⁴⁴

It is desired to utilize bombing squadrons assigned or attached to the First Army for the purpose of cooperating in the general mission of the Air Service, in defeating the enemy's aviation, interfering with his concentration of troops and matériel on the ground, taking part in combat against his fighting troops, and exploiting their defeat. . . .

Beginning at once, it is desired to have night bombers, British and French attack: (a) Enemy airdromes and parks and endeavor to cripple his Air Service by destroying planes, hangars, aviation matériel and personnel on the ground. . . (b) Railroad centers and lines. . . (c) Concentrations of troops and supplies. . . .⁴⁵

These general remarks from the First Army Assistant Chief of Staff Colonel Robert McCleave to First Army Chief of Air Service Colonel William Mitchell outlined the activities for the period of preparation for the attack. No airdromes seem to have been hit, however, until September 26, the opening day of the Meuse-Argonne offensive. While the daylight hours were rainy and foggy, the nights were clear, making possible nightly attacks by the British Independent Air Force on

⁴⁴"Tactical History of Day Bombardment at St. Mihiel," 1918, D, Hy AS AEF, Vol. 1, pp. 132-133.

⁴⁵Letter from the First Army Assistant Chief of Staff, G-3, to the Chief of Air Service, First Army, dated August 23, 1918, in Lahm Collection, USAF HD Archives.

Longuyon, Conflans, Metz, and other rail points which the enemy was using to bring up reserves.⁴⁶ The French night bombardment group, augmented by one Italian squadron, also attacked these points as well as enemy posts of command and concentration centers nearer the front. Enemy bombers were also active by night and the French night bombardment group was used for keeping watch over the enemy's nocturnal activity as well as for bombing.⁴⁷

The primary targets of the 1st Day Bombardment Group during the St. Mihiel offensive were hostile troop concentrations immediately behind enemy lines; railroad centers congested with troops and supplies were secondary objectives. Bombing expeditions were sent against bridges and bridgeheads between Pont-à-Mousson and Metz to interfere with traffic or reinforcements and supplies from the sector east of the Moselle River. The main object of day bombardment during the offensive was to confuse and to destroy enemy troops marching into, or retreating from, battle.⁴⁸ During the days of exploitation, the bombers continued to hamper as much as possible the enemy's withdrawal of personnel and matériel.⁴⁹

Because of unfavorable flying weather throughout the entire campaign together with the shortage of airplanes and the muddy airfield,

⁴⁶ Jones, The War in the Air, VI, 148-149.

⁴⁷ Mitchell, Memoirs of World War I, pp. 239-241.

⁴⁸ Memorandum from First Army Chief of Staff to Chief of Air Service, First Army, September 11, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VIII, 240-241.

⁴⁹ "Tactical History of Day Bombardment at St. Mihiel," 1918, D, Hy AS AEF, Vol. 1, pp. 132-133.

the bomber formations which crossed enemy lines were too small to cope with the German aerial opposition. A closed V formation of 14 or 16 bombers was self-protected against ordinary attack, but a formation of six bi-place planes did not have sufficient armament to withstand an organized attack by 20 to 30 airplanes. Enemy pursuit would break off combat with Allied pursuit to attack the bombers, making every effort to wipe them out. By operating deep within the German lines, Allied bombers kept large forces of enemy pursuit planes away from the front and indirectly protected Allied observation planes. The bombers, however, suffered heavy losses. On September 18 five out of six DH 4's failed to return from a mission. During the first four days of the attack, the 96th Squadron lost 16 fliers; the 11th Squadron lost 12 of its flying personnel, and the 20th Squadron lost 3. The total number of casualties for the 1st Day Bombardment Group in this campaign was 31.⁵⁰

Pursuit

At the beginning of September all American pursuit units with the exception of the 17th and 148th Squadrons were concentrated in either the newly organized 1st Pursuit Wing, commanded by Colonel Bert M. Atkinson with headquarters at Toul, or the 1st Pursuit Group, commanded by Lieutenant Colonel Harold E. Hartney with headquarters at Rembercourt. The latter was composed of the 27th, 94th, and 147th Aero

⁵⁰ Ibid., pp. 133-134.

Squadrons.⁵¹ The 1st Pursuit Wing consisted of the 2d and 3d Pursuit Groups: the 2d Pursuit Group, commanded by Lieutenant Colonel Davenport Johnson, was made up of the 13th, 22d, 49th, and 139th Squadrons; the 3d Pursuit Group, commanded by Lieutenant Colonel William Thaw, was composed of the 28th, 93d, 103d, and 213th Squadrons.⁵² The French Groupe de Combat 16 was also assigned to the American 1st Pursuit Wing for duty in the offensive. In addition the First Army was allotted a French air division consisting of the French Escadre de Chasse 2d with headquarters at Ochev and three groups of French pursuit, forming a second escadre, with headquarters at Rancourt.⁵³ The headquarters of the French air division itself was located at Tannois.⁵⁴

Colonel William Mitchell, the Chief of Air Service, First Army, decided to use American pursuit aviation primarily to form a protective barrage or air cover along the front. In addition pursuit units were assigned four types of special missions: close protection of observation flights, escort duty with bombardment airplanes, balloon destruction, and ground strafing with machine guns and bombs.

During the preparation period from late in August to September 12 the 1st Pursuit Wing, flying over the front between the Meuse and

⁵¹"History of the Organization, Development, and Growth of the 1st Pursuit Group," 1918, C, Hy AS AEF, Vol. 9, p. 37.

⁵²"History of the First Pursuit Wing, St. Mihiel," 1918, C, Hy AS AEF, Vol. 7, p. 163.

⁵³Letter from Chief of Air Service, First Army, to Chief of Staff, First Army, September 7, 1918, in Department of the Army, United States Army in the World War, 1917-1919, VIII, 227.

⁵⁴Special Order Number 163, First Army, AEF, September 8, 1918, ibid., p. 228.

Moselle Rivers, maintained patrols adequate to prevent enemy reconnaissance and to protect Allied observation planes. A double tier barrage was in the air from daylight to dark, with the lower patrol flying at from 8,000 to 12,000 feet and the higher patrol from 12,000 to 16,500 feet; the patrols overlapped each other by 15 minutes. They were not authorized to penetrate the enemy lines more than about three miles.⁵⁵

The 1st Pursuit Group moved quietly into Rembercourt airdrome west of the Meuse and took up duties similar to those of the 1st Pursuit Wing, preventing enemy reconnaissance of the V Corps area and protecting Allied observation planes, using as few planes as possible in order to preserve the secrecy of its location.⁵⁶ Before the offensive got under way, the headquarters staff of the 1st Pursuit Group spent most of its time perfecting liaison with other organizations while the pilots acquainted themselves with the new territory. Several advance landing fields were spotted for possible use during the Allied offensive.

High winds, low clouds, and intermittent rain prevailed on September 10, 11, and 12, but on orders from the First Army, both the 1st Pursuit Wing and the 1st Pursuit Group performed valuable individual reconnaissances as deep as Étain, Vigneulles-les-Hattonchâtel, and Thiaucourt. These missions, made in foul weather, against heavy anti-aircraft and machine gun fire, and at altitudes of 1,400 feet or less, disclosed that the Germans were preparing to withdraw from the salient.⁵⁷

⁵⁵"History of the First Pursuit Wing, St. Mihiel," 1918, C, Hy AS AEF, Vol. 7, p. 171.

⁵⁶"Tactical History of American Pursuit Aviation, St. Mihiel," 1918, D, Hy AS AEF, Vol. 1, pp. 98-100.

⁵⁷Ibid., pp. 94-98.

On September 12 infantry units of the First Army had begun their advance into the St. Mihiel salient. Because of the bad weather the usual pursuit functions could not be performed, but pursuit pilots reported valuable battle information and harassed retreating enemy columns with machine gun fire and bombs. Planes of the 3d Pursuit Group, armed with small bombs, destroyed a number of German trucks. Captain Meni of the French Groupe de Combat No. 16 made a low visual reconnaissance flight in the area of Montsec and Loupmont and brought back the news that these commanding heights had been taken by American troops.⁵⁸ The enemy concentrated his air units in force on this front on the first day of the American advance. Although German pursuit patrols of more than six aircraft had rarely been encountered there prior to this time, large formations now began to appear. Consequently, Allied patrols should also have been augmented; however, few large patrols were used during the first day of the attack. Single Allied pursuit planes flying as low as 160 feet reported the advance of the front lines.⁵⁹

On the second day of the attack, September 13, the Germans were still in retreat. The 3d Pursuit Group, protected by elements of the 2d Pursuit Group, flew five missions, bombing and harassing enemy infantry units with bombs and machine gun strafing, while protective patrols were maintained at different altitudes to keep enemy pursuit away.⁶⁰

⁵⁸"History of the First Pursuit Wing, St. Mihiel," 1918, C, Hy AS AEF, Vol. 7, p. 172.

⁵⁹Ibid., pp. 173-174.

⁶⁰Ibid., p. 176.

On September 14 the good weather accelerated aerial activity, especially east of the Meuse River. Large concentrations of enemy pursuit machines of the latest type were met and savage combats ensued. At least four new enemy organizations were identified, but the Germans were outnumbered--the Allies had at last gained aerial superiority. The 1st Pursuit Wing increased the size of its patrols, often employing more than one squadron for a mission.⁶¹ During the final phases of the St. Mihiel campaign, when weather conditions prevented the use of bi-place machines, pursuit airplanes were employed in low-level attacks on enemy balloons and low-flying battle planes, as well as for observation and reconnaissance.⁶²

While there were fewer flights on the front patrolled by the 1st Pursuit Group, a number of German balloons as well as enemy planes were shot down. So many balloons were brought down by the 1st Pursuit Group that it is doubtful whether the enemy received much information from his balloons on the western side of the salient. Second Lieutenants Frank Luke, Jr., and Joe Wehner of the 27th Pursuit Squadron were the chief exponents of "balloon busting." Frank Luke, who conceived the idea of pursuing balloons at dawn or just at dusk, shot down 18 enemy aircraft (mostly balloons) during the last three weeks of September, 1918.⁶³ On September 18 he brought down three planes and two balloons in a period of 10 minutes. On September 29, after shooting down three

⁶¹Ibid., p. 176.

⁶²"Tactical History of American Pursuit Aviation, St. Mihiel," 1918, D, Hy AS AEF, Vol. 1, p. 102.

⁶³Gurney, Five Down and Glory, pp. 48-49.

enemy balloons to avenge the death of his partner Joe Wehner (who had been killed saving Luke's life), Luke, followed by eight German planes, flew down on a group of German soldiers and opened fire, killing six men and wounding others. His plane was forced down behind enemy lines near Murvaux. He was quickly surrounded by German troopers. Luke refused to surrender, pulled out his pistol, and fought until he himself was killed. He was the first flier to be awarded the Congressional Medal of Honor, although it was granted posthumously.⁶⁴

Balloons

Fifteen American and six French balloon companies, all of them under American command, took part in the St. Mihiel campaign. Each front line division and each corps was assigned a balloon unit to regulate artillery fire and six balloon companies were assigned to the army artillery. Throughout the four days of the offensive the balloon companies were assigned and deployed as follows: with the I Corps, the 1st Balloon Company at Domèvre-en-Haye, the 2d at Griscourt, the 5th at Dieulouard, and the 42d at Ville-au-Val; with the IV Corps, the 3d Balloon Company at Villers-sur-Meuse, the 7th at Sommedieue, the 8th at Dieue-sur-Meuse, and the 12th at Rattentant; and with the French II Colonial Corps, the 20th Balloon Company at Thillombois, the 52d at

⁶⁴ Edward V. Rickenbacker received the Congressional Medal of Honor for action on September 25, 1918, while Luke's was for action performed on September 29. Rickenbacker was not presented the medal until years later, while Luke's father received his son's award soon after his son's death. U.S., Department of the Army, Medal of Honor of the United States of America (Washington: Government Printing Office, 1948), pp. 254, 258.

Bannoncourt, and the 53d at Vignot (all French units). Assigned to the army artillery were the 10th Balloon Company at Ansauville, the 11th at Cezpucourt, the 16th at Toul (all American units); and the 39th at Minorville, the 41st at Gironville, and the 93d at Génicourt-sur-Meuse (all French units).⁶⁵

In so far as the proximity to the front permitted, German positions were thoroughly reconnoitered from balloons before the attack. The ideal observation position for balloons was an altitude of one mile and about four miles behind the lines. The territory beyond the front line was carefully studied from maps and photographs. Definite itineraries of advance were planned and the positions beyond the lines so determined that each balloon could maintain its approximate place during the offensive. Hydrogen for the balloons was distributed from the depots at Chandenev and Rattentant and baskets and other accessories were procured from air depots at Paris. No shortage in equipment was encountered to limit balloon operations. Telephone connections between balloons and artillery and associated ground units were adequate and efficient. Each balloon company kept one officer at the headquarters to which it was assigned.⁶⁶

On September 12, after the initial assault, the infantry advanced according to schedule to the first phase line. Resistance was weak and ineffective and by 4 o'clock that afternoon all divisions had

⁶⁵"Balloon Operations in Offensive Combat: St. Mihiel," 1918, F, Hy AS AEF, Vol. 2, pp. 356-357. See also "Employment of Balloons in the St. Mihiel Offensive," 1918, in USAF HD Archives.

⁶⁶Lawrence F. Stone, "Will Balloons Be Used in the Next War?" 1928, pp. 23-24, in USAF HD Archives.

reached their objectives. Due to intermittent rain, low clouds, and poor visibility, reconnaissance was extremely difficult and on the whole only partially successful during the day. In practically every instance balloons were up at daybreak on the morning of the attack. One balloon in each corps was in ascension during the night preceding the assault and during each night while the attack continued.⁶⁷

On the second day of operations, the 90th Division exploited its advance, taking the town of Vilcey-sur-Trey and establishing outposts one half mile south of Villers-sous-Prény. Visibility continued poor throughout the day and observations remained almost impossible. Although three daylight ascensions and one night ascension were accomplished, results were negligible. The infantry had advanced and the balloons were too far back to render much assistance even if weather conditions had permitted it. Congested traffic did not permit movement of balloon units to advanced positions.⁶⁸

Organization of the front line continued on the third day of the campaign, September 14. Further exploitations by the 90th Division advanced the line to Villers-sous-Prény and Norroy. A marked improvement in weather conditions was noticeable throughout the day. The balloons were able to advance and were now able to give valuable aid to their divisions. Thirteen day and one night ascensions were made by the balloons with good results; two artillery adjustments were made during the 37 hours spent in the air.⁶⁹

⁶⁷ "Balloon Activity and Operations of Air Service During Recent Activity, St. Mihiel," 1918, C, Hy AS AEF, Vol. 3, pp. 435-439.

⁶⁸ Ibid., pp. 439-442.

⁶⁹ Ibid., pp. 442-443.

On the following day of operations, September 15, conditions were somewhat stabilized and the sector was fairly quiet. The weather returned to its former unfavorable status. Seven ascensions were made, five artillery adjustments were completed, and almost 34 hours of observation were logged.⁷⁰

On September 16, American balloons reported shells falling 16 times; reported enemy balloons 50 times; reported enemy planes 119 times; reported circulation on roads 23 times; and spotted 35 enemy artillery batteries. American balloon observers spent over 140 hours in the air on this date. Foul weather during the first two days of the attack had prohibited the regulation of artillery fire. The balloons on subsequent days, however, conducted successful adjustments. On September 16 the 2d Balloon Company regulated 157 shots for the artillery; on the same day the 3d Balloon Company adjusted 118 shots for artillery batteries, and the 11th Company regulated 128 shots.⁷¹

During the first two days of the campaign, weather conditions had limited balloon observations; high winds had damaged balloons which ascended. On September 12, when the 10th Company's balloon was blown to the ground, the observer, First Lieutenant David G. Boyd, had his leg broken and back sprained. On the same day, the 12th Balloon Company's balloon broke its cable and carried Lieutenants George W. Hinman and Roland S. Tait behind the German lines where they were

⁷⁰ Ibid., p. 435.

⁷¹ Lawrence F. Stone, "Will Balloons Be Used in the Next War?" 1928, pp. 24-25, in USAF HD Archives.

captured.⁷² On the 13th the balloon of the French 20th Balloon Company was damaged when a high wind blew it into some trees. On September 14 an American Salmson collided with the cable of the 2d Balloon Company, wrecking the plane and killing both pilot and observer but causing no appreciable damage to the balloon. During the first two days of the St. Mihiel operation, enemy planes destroyed balloons of the 1st, 2d, and 5th Balloon Companies. On September 16 the balloon of the 9th Company was deflated by enemy artillery fire.⁷³

During the winter of 1918 propaganda distribution by free balloons was planned; technical difficulties intervened and few propaganda balloons were released by the American forces before the end of hostilities. On September 17, 1918, at Dommartin-la-Montagne in the St. Mihiel salient, the first eight balloons were successfully floated over the German lines by the 6th Balloon Company. These balloons and the ones subsequently used were supplied by the French. About nine feet long, they were made of chemically treated paper and could carry four pounds of leaflets (about 600 sheets). The balloons utilized a simple release consisting of a fuse and hangers to which bunches of leaflets were attached. As the fuse burned, the wire-bound bunches of paper fell free and scattered.⁷⁴

⁷²George W. Hinman, "Experiences as a Prisoner of War," 1918, M, Hy AS AEF, Vol. 10, pp. 155-168.

⁷³"Balloon Activity and Operations of Air Service During Recent Activity, St. Mihiel," 1918, C, Hy AS AEF, Vol. 3, pp. 445-446.

⁷⁴Charles Chandler, "Report on the Balloon Section, Air Service, AEF," December 31, 1918, p. 35, in USAF HD Archives.

Conclusion

The American First Army operation at St. Mihiel was a success. The objectives assigned were reached in much less than the scheduled time. In addition, the line east of the Moselle River was advanced to Norroy. Although for the most part atmospheric conditions were unfavorable for aerial observation, the Air Service was able to cooperate successfully with the advancing divisions and with the corps, keeping them informed as to the position of the front, giving accurate information as to what opposition they would meet, and having the enemy sector constantly under surveillance to preclude any surprise counteroffensive. Roads and towns in rear areas were carefully watched and suspicious indications of German activity were noted and reported immediately. Photographs taken were invaluable to the advancing troops and to the First Army General Staff directing the operation. In many instances the Air Service aided advancing infantry by strafing enemy troops on the ground, and on several occasions Allied planes forced German soldiers to abandon their posts.

A significant measure of the degree of tactical surprise attained at St. Mihiel was the overwhelming numerical superiority of the American and French aerial forces at the beginning of the action--almost 1,500 against an estimated 300 German airplanes. For the first time the Americans had greater strength in the air than the enemy. They were able to capture and maintain the initiative in spite of increasing opposition from the Germans, who brought in some of their best pursuit

units from other parts of the front.⁷⁵

Taken as a whole the operation at St. Mihiel was a success for the Air Service. It stimulated the confidence of the line troops toward the Air Service and demonstrated to the other branches of the First Army, including the General Staff, that if properly employed, the Air Service was a useful arm of the service. The St. Mihiel campaign was invaluable in instructing various line organizations in the proper utilization, possibilities, and limitations of aerial observation.

⁷⁵American aviators kept command of the air. They brought down 12 balloons and more than 60 German planes, while losing less than a third of that number. See Cablegram Number 137 from General Headquarters, American Expeditionary Forces to Washington, September 28, 1918, in Department of the Army, United States Army in the World War, 1917-1919, XIII, 335.

CHAPTER XII

OPERATIONS IN THE MEUSE-ARGONNE CAMPAIGN

Introduction

One of the most far-reaching effects of the rapid increase of American troops in Europe, and the subsequent Allied and American successes during the summer of 1918, was that it became possible to undertake in September a gigantic convergent offensive against the German forces on the western front. Plans for this movement were agreed upon and as a formality of coordination were promulgated by Marshal Foch, the Allied Commander-in-Chief, on September 3, 1918. Under these plans, the American forces were to advance northward between the Meuse River and the Argonne Forest, supported on the left by the French Fourth Army west of the Argonne. Northeast of Paris the French armies were to renew their efforts to force the Germans back from the Aisne River, while farther north the British were to continue operations in the direction of St. Quentin and Cambrai. The Allies also planned to attack near Ypres to free the Belgian coast.

The significance of the American part in the general plan lay in the fact that its attack was to be directed against a most vital point in the German system of railroad communications. An attack in the vicinity of the Meuse River, if carried far enough to gain control of these railways, would divide the German armies. Once this was

accomplished, Germany would be unable to maintain her forces in France and Belgium because communications would be practically impossible except by the long and circuitous route through Liége and the Rhine River Valley.

When the decision was made to attack in the Meuse-Argonne region the American First Army was busily engaged in preparations for the St. Mihiel offensive, planned for September 12. Because of the limited time available, however, the assembly of American divisions not scheduled for the St. Mihiel attack was begun immediately and detailed plans for the larger battle were prepared at once.

The movement of men and matériel was made entirely under cover of darkness, all activity being suspended and the men kept in concealment during daylight hours. Consequently, the roads leading into the area were scenes of activity at night as troops and artillery, ammunition, and supplies moved steadily forward. On most of the Meuse-Argonne front French soldiers remained in the outpost positions until the last minute to prevent the Germans from seeing or otherwise securing information of the presence of large numbers of American soldiers in the region and thus receiving advance warning of the impending offensive. In all, about 220,000 Allied soldiers were moved out of the area and approximately 600,000 Americans were moved into it.

Finally on the night of September 25-26 the First Army stood on its new front, ready for the momentous battle that was to begin at dawn. The III Corps was on the right, the V Corps was in the center, and the I Corps was on the left. Opposing the American First Army were the German Third and Fifth Armies.

On September 26, 1918, after a three-hour artillery bombardment, the Meuse-Argonne offensive, the final campaign of World War I, was launched. The action in this campaign performed by American forces supported by French units may be divided into three distinct phases. The first phase, taking place in late September, included an initial attack and successful advance. The second phase, covering the month of October, was one of bitter fighting, during which American troops advanced slowly, wearing out the enemy and enlarging the front of the attack. The third and last phase, beginning in November, was a general assault by the American Expeditionary Forces, who advanced and forced the enemy back until hostilities ceased on November 11, 1918.

In this offensive, the Allies were operating from a salient which made them vulnerable to aerial attack because of the transportation congestion of both men and supplies. Brigadier General William Mitchell's forces struck first, gained ascendancy in the air and bombed German supply centers, forcing the enemy to hold back some of his planes to defend his rear areas. The number of aircraft under Mitchell's command was much smaller than it had been in the St. Mihiel campaign, consisting initially of only 300 planes, of which almost 600 were assigned to American Air Service units.¹ Before the beginning of the Meuse-Argonne offensive the French had withdrawn nearly three quarters of their planes which had taken part in the St. Mihiel operations.²

¹Morris and Kendall, Ceiling Unlimited, p. 182.

²Letter from Chief of Staff, French Armies of the North and Northeast to the Commander-in-Chief, AEF, dated September 18, 1918, in Department of the Army, United States Army in the World War, 1917-1919, IX, 37-38.

Corps Observation

Shortly after the conclusion of the St. Mihiel offensive a redistribution of units took place between various Air Service organizations in preparation for the operations planned for the fall of 1918. The IV Corps front was to be enlarged to include the sector occupied by the I Corps during the St. Mihiel campaign. The IV Corps, the French II Colonial Corps, and the French XXXIII Corps remained in place and did not take part in the Meuse-Argonne offensive. The 90th Aero Squadron was relieved from the IV Corps Observation Group, leaving the American 8th and 135th Squadrons and French 218th Squadron in the IV Corps Group at Ourches.³ The Air Service organization of the French II Colonial Corps was composed of the same squadrons as had participated in the St. Mihiel offensive. The Air Service of the French XXXIII Corps was made up of French squadrons with headquarters at Beuzee.

The American I, III, and V Corps were to take part in the next main offensive. The III Corps Air Service, headed by Captain William J. Schieffelin, Jr., with its units deployed at Souilly, Vadelaincourt, and Beuzee, was composed of the 88th and 90th Aero Squadrons and the French 205th and 234th Squadrons.⁴ The Air Service of the V Corps, under the command of Major Martin F. Scanlon, included the American 99th and 104th Squadrons and the French 214th and 215th Squadrons.⁵

³"History of the 90th Aero Squadron," 1918, E, Hy AS AEF, Vol. 9, p. 210.

⁴"History of the III Corps Observation Group," 1918, C, Hy AS AEF, Vol. 13, p. 214.

⁵"History of the V Corps Observation Group," 1918, C, Hy AS AEF, Vol. 14, p. 109.

These units were stationed at the Foucaucourt airdrome. The 1st, 12th, and 50th Aero Squadrons and one French squadron located at Remicourt made up the observation units for the I Corps, commanded by Lieutenant Arthur J. Coyle.⁶

In the Meuse-Argonne operations, the headquarters of each corps chief of Air Service was established at the corps headquarters. Experience had shown that many of the difficulties encountered by the Air Service were connected with problems of liaison. The inadequate training possessed by line organizations in the use and limitations of the Air Service also suggested this plan. Although a close supervision of the daily operations of the groups and squadrons by the chief of Air Service was much to be desired, nevertheless this consideration was outweighed by the advantage of locating the chief of Air Service at corps headquarters. Headquarters for the Corps Observation Wing (commanded by Major Melvin A. Hall) was located at Chaumont-sur-Aire where the 1st Pursuit Wing headquarters (commanded by Major Bert M. Atkinson) was also established.⁷ Headquarters for the First Army Chief of Air Service, Brigadier General William Mitchell, was organized at Souilly.

The tactical situation which existed at the onset of the Meuse-Argonne campaign was in many respects similar to that existing before the St. Mihiel offensive. The positions occupied by the ground troops

⁶"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 30.

⁷"History of the 1st Pursuit Wing Headquarters from the Time of its Organization to the Present Date," November 18, 1918, N, Hy AS AEF, Vol. 7, p. 3.

of the three American corps which were to participate in the main attack were strongly organized by means of trench works, barbed wire entanglements, and machine gun emplacements. Besides the usual amount of artillery immediately to the rear of infantry positions there was a formidable concentration of heavy artillery located throughout the area to the west of Verdun. With the exception of the French aerial forces, which had been relieved, the other branches of the First Army Air Service remained approximately at the same strength as had fought in the St. Mihiel campaign.

The Germans occupied positions of great strength along the entire front of the First Army. Intricate trench systems and well-organized strong points protected by barbed wire entanglements were occupied by enemy infantry units supported by a sizable array of artillery. Here as in the St. Mihiel salient the heavily wooded terrain gave the enemy the advantage for a prolonged resistance to attack.

Since September 14, 1918, when the comparatively negligible hostile pursuit forces of the St. Mihiel sector were augmented by the arrival of some of the best German squadrons, the enemy air forces had been greatly increased in the area opposite the Meuse-Argonne sector by the addition of pursuit, observation, and bombardment units. The success of the Allied offensives further west had made it increasingly important to the enemy that no advance be made by the Allied armies in the Meuse-Argonne sector. As a consequence, a large number of his best aerial units were sent to operate in the latter region.

The necessity for complete secrecy during the preparation of the Meuse-Argonne offensive prevented all operations on the part of

new American observation units brought into the sector until the day set for the beginning of the offensive. Only the French squadrons which had been working in the sector for a considerable time were allowed to carry out their routine reconnaissance, photography, and artillery adjustment missions.

Detailed plans of employment of aerial units under their command were prepared by the commanding officers of each corps observation group. Newly arrived observers of the American squadrons were to fly with pilots of the French squadrons already operating at the front so they could familiarize themselves with the new sector before the day of attack. Observers who were to act as liaison officers were sent to the command posts in each division. Other liaison officers were stationed with the corps to the right and left of the First Army. Measures were taken to procure the detailed information necessary to carry out each type of observation mission and to insure the rapid transmission of such information to observation units after the opening of the offensive. Careful plans of the precise methods to be employed in cooperating with artillery were drawn up and were discussed with artillery officers during visits made by Air Service officers to artillery command posts. Particular attention was given to training infantry units in marking the front line by panels during infantry contact patrols. Personal visits were made to many radio stations by squadron radio officers to insure communications between the Air Service and command posts. Whenever possible, exercises were conducted with artillery and infantry units before they entered the lines.

Soon after the two American squadrons of the III Corps

Observation Group arrived at Souilly, an infantry contact school was established and operated under the same general plan as the one organized by the III Corps Observation Group on the Vesle.⁸ Soon thereafter similar schools were established at the airdromes of the I and V Corps Observation Groups.⁹

Steps were taken to guard against repeated radio failure between the airplane and ground stations. When an airplane (whose radio set had been successfully tested over the field before departure) called and failed to receive a response from a command post radio station, a memorandum noting the instance was forwarded to the corps chief signal officer for proper action to prevent a recurrence.

In assigning missions to squadrons, general plans developed in earlier campaigns were used. In each corps observation group there was one French heavy artillery squadron to which all surveillance and adjustment of fire for heavy artillery was assigned.¹⁰ Other missions were more or less evenly divided among the remaining squadrons. In cases where it was impracticable to furnish protection by observation planes from the group itself, arrangements were made for protection of photographic missions by pursuit escorts. The plan consisted of

⁸"History of the III Corps Observation Group," 1918, C, Hy AS AEF, Vol. 13, p. 217.

⁹"History of the I Corps Observation Group," 1918, C, Hy AS AEF, Vol. 12, p. 83, and "History of the V Corps Observation Group," 1918, C, Hy AS AEF, Vol. 14, p. 122.

¹⁰Letter from Chief of Staff, French Armies of the North and Northeast to the Commander-in-Chief, AEF, dated September 18, 1918, in Department of the Army, United States Army in the World War, 1917-1919, IX, 37.

diverting a pursuit patrol from its regular barrage patrol at the hour desired. All arrangements as to the exact time and place of rendezvous, the course to be pursued, and other such matters were left to the photographic and pursuit patrol leaders.¹¹

Each type of observation mission carried out by the American Air Service during the Meuse-Argonne offensive will be discussed separately rather than attempt to narrate the activities of each unit in turn. The unfavorable weather encountered during the St. Mihiel offensive continued the greater part of the time between September 26 and November 11, 1918. There were occasional days ideal for flying but for the most part atmospheric conditions were poor to impossible and proved a great handicap in carrying out aerial operations. Haze and fog obscured the ground to a great extent in the early morning and late afternoon during the last four weeks of the offensive. In considering the work performed by the observation units these weather conditions should be kept in mind as an element which affected the execution of each type of mission. In the matter of reconnaissance and infantry contact patrols they produced some radical departures from the methods ordinarily used.

Most of the photographic missions undertaken from September 26 to November 11 were confined to well-defined areas specified by the intelligence sections of the corps staffs. Atmospheric conditions were so infrequently favorable for taking photographs that the missions were necessarily directed to cover areas of the most immediate interest.

¹¹Operations Order Number 11, Chief of Air Service, First Army, September 28, 1918, C, Hy AS AEF, Vol. 12, p. 56.

Elaborate preparations were made to have airplanes ready to take off at the slightest prospect of success. All photographic missions were ordered by the intelligence section of the corps general staff; they were carefully prepared by the squadron observers working in conjunction with the branch intelligence officer of the group, and at the first sign of the approach of favorable atmospheric conditions the missions left the airdrome. As had been the case during the preparation of the St. Mihiel offensive, oblique photographs were particularly useful in making plans for the advance of infantry units. At other times it was necessary to photograph certain sensitive points in the German lines. These missions were generally assigned to flying teams who were thoroughly familiar with the exact locality to be photographed so that no mistake would be made in securing photographs of the exact points.

Unfavorable weather prevailed to such an extent that it was never practical to attempt to photograph all the area of the front lines as fast as the troops advanced. The most hoped for was a collection of photographs of the areas most important in view of the tactical situation. At certain times during the offensive, when the need for photographs became imperative, missions of this nature were dispatched even when atmospheric conditions made their failure almost certain. This was done in the hope of seizing advantage of a momentary break in the clouds or fog after reaching the lines. It is interesting to note that considerable success met these efforts. At times when the weather was comparatively favorable in the vicinity of the airfields, the sky might be a mass of clouds over the front lines. At other times when fog and mist made it quite difficult to take off at the airdrome,

missions operating over the lines to a depth of five miles over enemy territory were able to secure a number of useful photographs.¹²

In the Meuse-Argonne offensive, as had been the case on the Marne, photographic missions were invariably given protection against hostile pursuit planes. The large number of enemy pursuit flights operating in the sector made it practically a certainty that a photography plane would be attacked during the course of a mission. Pursuit escorts were utilized to a large extent by photographic missions dispatched from the III Corps Observation Group with good results.¹³ On the other hand, most of the photography missions sent out by the I and V Corps Observation Groups employed bi-place protection offered by airplanes of the observation groups themselves. The pursuit escorts, however, did not operate close to the photographic plane as they had in the Marne sector. It was found that by flying a more or less erratic course 1,500 feet above the photography airplanes, better results could be obtained. This allowed the pursuit planes to retain the advantage of their maneuverability and at the same time assured the photographic mission considerable protection in the event of attack.¹⁴ Both pursuit and bi-place protection resulted in some loss to the protective planes. In the majority of cases, protection of some sort insured the safe return of photography planes. Toward the latter part of the offensive, the diversion created by Allied bombing

¹²"History of the III Corps Observation Group," 1918, C, Hy AS AEF, Vol. 13, pp. 230-233.

¹³Ibid., p. 234.

¹⁴Operations Order Number 28, Chief of Air Service, First Army, October 16, 1918, C, Hy AS AEF, Vol. 12, pp. 93-94.

and pursuit formations provided incidental protection to photographic missions. Since observation units knew the hours for such raids, photographic teams were able to time their missions so as to take advantage of the protection offered by the presence of these raiding planes.¹⁵

As in previous offensives, the most important Air Service accomplishment for the artillery was surveillance. Whenever it was possible to distinguish objects on the ground, much useful information was obtained and forwarded to various artillery command posts. Particular attention was paid during these missions to locating and reporting the positions of hostile artillery batteries. Special maps were prepared which allowed the observer to signal the artillery batteries assigned to fire on certain areas marked off on the map.

A variety of circumstances combined to nullify Air Service efforts to direct artillery fire on fugitive targets. Despite attempts to prevent such occurrences, artillery radio stations repeatedly failed to respond to calls from airplanes. Dropped written messages requesting artillery fire were seldom effective in accomplishing more than the transmission of information concerning the location of fugitive targets. Although in some instances fire was regulated on fugitive targets, they usually disappeared before the artillery took any action.¹⁶ During rapid advances it was impossible to assign

¹⁵"Observation Operations in the Meuse-Argonne Campaign," 1918, C, Hy AS AEF, Vol. 3, p. 447.

¹⁶Operations Report, Headquarters, I Corps, AEF, Rarécourt, September 27, 1918, Department of the Army, United States Army in the World War, 1917-1919, IX, 168.

special artillery batteries or battalions to fugitive target work. Information as to battery positions at such times was seldom available before further movement became necessary. Every difficulty encountered on the Marne during attempts to conduct fugitive target fire with specially designated batteries or battalions was encountered anew. Unfavorable weather also made attempts to adjust artillery fire by airplane observation teams exceedingly difficult.¹⁷

Visual reconnaissance missions were carried out daily at dawn and twilight. Additional reconnaissance flights were executed throughout the day whenever warranted by the tactical situation. Nothing short of heavy rain or fog was allowed to interfere; planes left the airdrome even when atmospheric conditions were most unfavorable. At the front there were occasional moments when observations could be conducted through the clouds and mist. At times the information reported by aerial observers was the sole intelligence for the command in following developments along the front lines and within enemy territory. When it was possible to fly, reconnaissance flights kept the front lines under surveillance along the entire Allied front to a distance of five miles within hostile rear areas. Many special missions observed and reported on enemy activity at designated points.¹⁸

Aerial observation teams were particularly diligent in their conduct of infantry contact patrols. Perhaps the grim necessity of

¹⁷Melvin A. Hall, "Report on Work Done with the Artillery Brigade of the 82d Division," October 13, 1918, C, Hy AS AEF, Vol. 7, p. 86.

¹⁸"Observation Operations in the Meuse-Argonne Campaign," 1918, C, Hy AS AEF, Vol. 3, pp. 420-428.

locating front line units inspired these lines set to the tune of "When You Come to the End of a Perfect Day," a nostalgic song written by Carrie Jacobs Bond, popular during World War I:

When you sit on the edge of your bunk all day,
 With a map of France in your hand;
 And you search for a spot out in no-man's land,
 Not so very far away;
 And you know that the archies are bursting fine,
 And the 50th is on its way,
 And you know that our pilots have found the line,
 That's the end of a perfect day.¹⁹

On October 6, 1918, a plane from the 50th Aero Squadron was sent out to drop supplies to the isolated 2d Battalion, 308th Infantry Regiment, 77th Division, with whom contact had been lost. The wrong coordinates had been given for the "Lost Battalion,"²⁰ and no panels were displayed when called for. First Lieutenant Harold E. Goettler, the pilot, and his observer, Second Lieutenant Erwin R. Bleckley of the 130th Field Artillery, discovered as they were flying close to the ground that they were dropping food, ammunition, and medicine to German soldiers who were firing at them. On a second trip they flew still lower and their plane was brought down by enemy rifle and machine gun fire, killing both officers. Both men were awarded posthumously

¹⁹"Supplemental History of the 50th Aero Squadron, AEF," 1918, E, Hy AS AEF, Vol. 27, pp. 13-14.

²⁰The battalion was not really lost but had been enveloped by German forces. For several days it was fired upon by Allied artillery because its exact location was unknown. Pinned in by superior German forces, this decimated unit was caught up in a situation not unlike that of the American soldiers at Bastogne in World War II. The Germans demanded that the 2d surrender, but Maj. Charles W. Whittlesey reportedly answered, "Go to Hell," instead of Brig. Gen. Anthony C. MacAuliffe's famous reply, "Nuts." Thomas M. Johnson and Fletcher Pratt, The Lost Battalion (New York: Bobbs-Merrill Co., 1938).

the Congressional Medal of Honor.²¹ The 2d Battalion finally displayed its panels, the correct coordinates were marked, and the "Lost Battalion" was rescued the following day.²²

After the establishment of infantry contact schools at the airdromes of each observation group, there was an improvement in the performance of infantry contact patrols. While there were a large number of instances in which the observer was forced to fly at extremely low altitudes to locate the front lines by distinguishing the uniforms of the ground troops, on the whole, marking out the line by the infantry was far better than it had been in any previous campaign.²³

Many ground troops thought that American airplanes were to be recognized by a star painted on the bottom surface of the lower wings, an insignia which had been used in the United States. Even as late as October, 1918, the red, white, and blue concentric circle insignia used by American airplanes at the front was practically unknown. Failures of infantry units to respond to airplane signals were often due to their mistaken assumption that the airplanes they saw were not working with them.²⁴ Consequently, considerable effort had to be made

²¹Department of the Army, The Medal of Honor of the United States Army, p. 261.

²²Letter for Col. Thomas D. Milling, from Capt. D. P. Morse, Jr., "Data on 'Lost Battalion' (2d Battalion, 308th Infantry Regiment, 77th Division)," 50th Aero Squadron Headquarters, November 13, 1918, C, Hy AS AEF, Vol. 7, pp. 95-97.

²³Improvement in infantry contact work was noted by Air Service units working with the 1st, 2d, and 42d Divisions. Mitchell, Memoirs of World War I, p. 274.

²⁴Ibid., p. 261.

to clear up the misunderstanding. Printed circulars on the subject were dropped from observation planes. The divisional insignia was painted on the airplanes of some observation squadrons.²⁵ Observers were sometimes sent to infantry units on short personal visits which were of value to both the infantry and the Air Service in promoting knowledge concerning the activities of each arm.²⁶ During the last four weeks of the offensive, observation planes often carried newspapers, cigarettes, and pamphlets to drop to ground troops whenever opportunity presented itself.²⁷ The feeling of interest and friendship generated by these endeavors resulted in much better cooperation from soldiers during infantry contact patrols. Radio was almost entirely discontinued as a means of transmitting reconnaissance and contact patrol information. Although earlier training had contemplated the use of radio between planes and ground units, dropped written messages proved to be much more satisfactory.

Probably the most noticeable departure from methods employed in the past in the cooperation of the observation airplane with the infantry during attacks was the development, during the Meuse-Argonne campaign, of what became known as "cavalry reconnaissance" patrols. Observation planes flying at low altitudes conducted close observation

²⁵Memorandum Number 26, Headquarters, First Army Chief of Air Service, dated November 9, 1918, C, Hy AS AEF, Vol. 7, p. 5.

²⁶Alfred C. Georges, "Notes on Aerial Observation and Conversations While Attached to the 155th Infantry Brigade, 78th Division," November 8, 1918, C, Hy AS AEF, Vol. 7, p. 93.

²⁷A copy of one of the Air Service information sheets dropped to the doughboys is printed in Mitchell, Memoirs of World War I, pp. 262-263.

of the terrain immediately in front of advancing Allied infantry. After locating hostile machine gun nests, strong points, and other defenses likely to retard the attack, this information, together with the location and strength of enemy rear guards, was transmitted to front-line troops by dropped written messages. In this way infantry units were kept informed of developments in the area immediately ahead. These "cavalry reconnaissance" patrols frequently machine gunned concentrations of German soldiers who were impeding the progress of Allied infantry units.²⁸

Although large numbers of German pursuit planes were present throughout the Meuse-Argonne offensive, they were generally ineffective in hindering American Air Service operations. Pursuit squadrons of the First Army, maintaining a continuous aerial barrage along the front, were largely responsible for this favorable situation. Many combats between Air Service observation planes and hostile pursuit forces did occur during this protracted campaign, but comparatively small losses were suffered by American observation squadrons during such combats. By the adoption of novel tactics, observation planes proved their ability to defend themselves while successfully executing their assigned missions. Losses inflicted upon attacking enemy pursuit forces were considerably larger than those suffered by the American Air Service. One observation pilot, Captain William P. Erwin, who flew with a number of different observers, was officially credited with the

²⁸"Cavalry Reconnaissance Patrols," 1918, A, Hy AS AEF, Vol. 29, pp. 17-18.

destruction of nine enemy aircraft during the Meuse-Argonne offensive.²⁹

On October 8 First Lieutenant Arthur E. Easterbrook with Captain Erwin as pilot, successfully carried out a mission of locating advancing infantry units despite five encounters with enemy planes. During these engagements Lieutenant Easterbrook broke up a formation of three planes, sending one down out of control; killed or wounded an observer in an encounter with another formation; and sent a biplane crashing to the ground, besides driving away a formation of two planes and several single machines.³⁰

The command structure of the American Air Service corps observation organizations was not changed during the offensive. Under the unfortunate conditions of confusion following the rapid organization of the Air Service of the four corps observation groups from new and largely inexperienced units, the Corps Observation Wing headquarters as it functioned during the St. Mihiel and Meuse-Argonne offensives failed to justify its existence.³¹ Even under normal conditions this headquarters would probably have been unnecessary.

²⁹General Order Number 15, Headquarters, First Army Air Service, October 10, 1918, J, Hy AS AEF, Vol. 3, p. 463.

³⁰General Order Number 15, Headquarters, First Army Air Service, October 10, 1918, J, Hy AS AEF, Vol. 3, p. 463. Easterbrook was the only American observer rated an Ace in World War I. Gurney, Five Down and Glory, p. 279.

³¹In a memorandum written shortly after the war, Lt. Col. Lewis H. Brereton said that "The observation wing, as organized, has no reason for existing." He went on to suggest that the functions of the Corps Observation Wing could be performed more effectively by someone in the office of the army Air Service headquarters. Lewis H. Brereton, "History of Observation Wing, Air Service," January 21, 1919, C, Hy AS AEF, Vol. 7, pp. 1-2.

A review of the operations conducted by the American Air Service corps observation units during the Meuse-Argonne offensive shows a prevalence of conditions similar to those appearing in earlier campaigns. Unfavorable weather throughout the offensive proved a hindrance in the execution of photography and artillery missions. Here again, the greatest difficulties encountered arose through insufficient training of infantry and artillery units in the use and limitations of the Air Service. Cooperation with artillery batteries was unsatisfactory. In practically every case, faulty radio communication was the cause of the failure to adjust artillery fire. Reconnaissances were carried out with consistent success; whenever aerial operations were possible, the general staff was apprised of the situation along the front by complete and accurate reports. Cavalry reconnaissance patrols developed during this offensive proved valuable to advancing front-line ground troops. Patrols of this kind and infantry contact missions kept commanders informed throughout the advance. The infantry contact schools and steps taken to improve the cooperation of the Air Service with the infantry resulted in a marked improvement in infantry contact patrols during the later stages of the offensive. The marked success attained in the development of low-flying patrols during adverse weather was the outstanding feature of the American Air Service operations during the Meuse-Argonne offensive.

Army Observation

The 91st and 24th Squadrons of the First Army Observation

Group moved from Gondreville to Vavincourt, west of Verdun, on the 21st and 22d of September.³² Due to a shortage of pilots, two days were required for ferrying the planes to their new base. The 9th Squadron, equipped for night reconnaissance, had been transferred to this new field on September 20.³³

The airdrome at Vavincourt left much to be desired. It was located near a prominent crossing of two roads, making it an easy target for enemy bombers, and the landing strip was uneven. At the beginning of the operations the field was about 25 miles from the front. It is worth noting that in spite of the constantly increasing distance to the lines, missions were performed without difficulty throughout the whole offensive.³⁴

After arriving at their new station, flying teams of the First Army Observation Group acquainted themselves with the terrain and situation by flights over the lines in French airplanes already stationed in that sector. Thus they familiarized themselves with the area without indicating their presence to the enemy. Weather conditions remained more or less unfavorable during the period of preparation for the Meuse-Argonne campaign, with low clouds and fog obscuring the ground almost every morning and afternoon. In bad weather photographic missions were sent out to cover only the most important points, but in

³²"History of the 91st Aero Squadron, 1917-1934," p. 3, in USAF HD Archives.

³³"History of the 9th Aero Squadron," 1918, E, Hy AS AEF, Vol. 2, p. 7.

³⁴"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, pp. 227-228.

the brief periods when the weather was clear, many aerial photographs were taken.³⁵ Pursuit aircraft on patrol furnished some cover for photographic planes, but their primary mission was to attack the enemy.

The plan of employment, giving the duties to be performed by the Group during the coming offensive, was issued by the First Army on September 17th. The sector assigned to the Group was bounded on the east by a line through Verdun and Lamorteau, and on the west by a line through Vouziers and Mézières. Missions were to be carried out to an indeterminate depth. In practice, the eastern boundary did not exist, for orders were constantly received for missions in the area of the American Second Army. In general, the First Army Observation Group was responsible for the reconnaissance, both day and night, of the entire First Army sector. The artillery objectives for the first part of the offensive, indicated on a map, were to be photographed both before and after firing. Four planes, with pilots and observers, were to be stationed at the First Army Air Service headquarters for the purpose of carrying out command missions on orders from the Chief of Air Service, First Army.³⁶

Upon receipt of the above orders, Major John N. Reynolds, the Group Commander, formulated his plans for carrying them out. Four teams from the 9th Squadron were immediately sent to First Army Air Service headquarters for special missions requested by the staff there.

³⁵"History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, pp. 31-37.

³⁶Annex Number 4, Field Order Number 20, Headquarters, First Army, AEF, Ligny-en-Barrois, September 17, 1918, Department of the Army, United States Army in the World War, 1917-1919, IX, 99-100.

The night reconnaissance squadron was to conduct reconnaissances from early evening until daylight. Bombs were to be carried on these night missions and used against enemy convoys, troops, and military works.³⁷

The attack began on the morning of September 26 with ideal weather conditons prevailing. On the four days previous, low clouds and rain had prevented the completion of any successful reconnaissance flights. This had a decided effect on the first day's work; the lack of familiarity with the terrain, coupled with the activity of hostile air forces, interfered in securing photographs of artillery objectives and to some extent limited visual surveillance.³⁸

Generally speaking, the weather was poor throughout the entire Meuse-Argonne campaign. Only ten days out of the whole period were suitable for long-range reconnaissance, but the most was made of the small amount of good weather. The last three days of October gave ample opportunity for important flights in preparation for the November 1st attack. In spite of intense opposition by hostile aircraft, the areas opposite the American front were reconnoitered and photographed thoroughly.³⁹

One of the most valuable missions carried out during the last three days of October was photographing the army artillery objectives

³⁷"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, pp. 230-249.

³⁸"History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, pp. 40-41.

³⁹Operations Report, First Army, AEF, Souilly, October 28, 1918, in Department of the Army, United States Army in the World War, 1917-1919, IX, 352.

at Montmédy, Longwy, Spincourt, Dommery-Baroncourt, and Conflans-en-Jarnisy. The Germans had protected these points by intense anti-aircraft barrages and high patrols of pursuit planes, but in spite of these obstacles, the objectives were photographed both before and after registration of fire, allowing the artillery to fire effectively during the attack.⁴⁰

The observation teams which had been stationed at First Army Air Service headquarters proved to be efficient. The pilots and observers quartered at headquarters remained ready to carry out any mission during the daylight hours. The types of missions assigned varied from validating reports as to the location of front lines, to seeking out enemy reserves at points where counterattacks were expected. These assignments were carried out by single planes flying at extremely low altitudes. They sometimes penetrated hostile territory to a depth of ten miles and hence were constantly exposed to heavy machine gun and anti-aircraft artillery fire. Attacking enemy pursuit planes had every advantage of speed, maneuverability, and position when they engaged these flights in combat. The strain of flying under these conditions, coupled with the necessarily close confinement while awaiting orders, made it necessary that the teams be relieved every ten days, and replacements were drawn from each of the squadrons in the First Army Observation Group.⁴¹

⁴⁰"Tactical History of the Air Service, AEF," 1918, D, Hy AS AEF, Vol. 1, pp. 81-82.

⁴¹"History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, pp. 52-57.

Since most important military movements were made at night, the history of army observation would be incomplete without reference to night reconnaissance. For missions to be performed successfully, perfect conditions of visibility and a highly trained staff were necessary. The 9th Squadron was the only night reconnaissance unit in the American Air Service.⁴² The poor weather conditions throughout the Meuse-Argonne campaign gave little opportunity for the Squadron to perform its specialty. In spite of these handicaps, on the few nights suitable for observation, valuable information was obtained and some bomb damage was inflicted on the enemy.⁴³

The First Army Observation Group operated under difficulties throughout the entire Meuse-Argonne offensive. The field was located a long distance from the front lines and inadequate communications made it difficult for the First Army Observation Group Commander, Major Reynolds, to make the proper disposition of units under his command. Sometimes atmospheric conditions in the vicinity of the airdrome were

⁴²"History of the 9th Aero Squadron (Night Reconnaissance)," 1918, N, Hy AS AEF, Vol. 20, pp. 92-97.

⁴³"Night Reconnaissance in the Meuse-Argonne Offensive," 1918, A, Hy AS AEF, Vol. 29, p. 18. An interesting study of the 9th Aero Squadron's night observation operations in World War I was made by a student attending the Air Corps Tactical School at Montgomery, Alabama, in 1928. This student's analysis, based on the Squadron's operations reports, states that during the last few weeks of the war the great increase in the amount of useful information obtained under unfavorable visibility conditions was due to the experience gained by the observation teams. He concludes that the night surveillance flights were a success, for not only was an accurate estimate of the German activity gained but the presence of planes made the enemy immediately take steps to prevent aerial observation of his activities, with a corresponding interruption of his own operations. Harrison H. C. Richards, "The Use of Observation at Night," May 15, 1928, pp. 5-13, in USAF HD Archives.

such that a plane could not even attempt to leave the ground although 25 miles away at the front it might be perfectly clear. Because of inadequate communications, these conditions were not known by the Group.⁴⁴

The French De Ram 52 cm. automatic cameras proved to be unreliable. These cameras, received in September, were mounted and tested. They worked fairly well at first but later when on missions they were continually jamming. When the plates did not jam they were either unexposed or unevenly exposed.⁴⁵

The Chief of Staff of the First Army forwarded his orders to the Group through the branch intelligence officer and General William Mitchell, the Chief of the First Army Air Service, transmitted his orders direct to the Group. Having orders come through two separate channels and from two different authorities was a constant problem. By the time of the Armistice all operations orders for aviation units came directly from General Mitchell.⁴⁶

Bombardment

Under the command of Major James L. Dunsworth, the 1st Day Bombardment Group showed great improvement in the Meuse-Argonne offensive. The early history of Air Service bombardment units had

⁴⁴"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, p. 265.

⁴⁵"History and Report of Operations of the First Army Observation Group, First Army, AEF," 1918, N, Hy AS AEF, Vol. 20, pp. 79-82.

⁴⁶"History of the First Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, pp. 272-274.

been marked by heavy losses, and steps were taken to prevent a recurrence of this. Aerial gunnery and formation flying were practiced and improved greatly. Tight formations meant safety; an airplane that left the formation was almost certain to be lost. Objectives were attacked by the whole group rather than by a single squadron and these flights were coordinated with pursuit escorts. The 1st Day Bombardment Group operated under the control of the 1st Pursuit Wing. The combination of all these factors reduced American losses and increased those of the enemy.⁴⁷

In preparation for the Meuse-Argonne offensive, the 1st Day Bombardment Group moved to Maulan airdrome, near Ligny-en-Barrois, on September 23, 1918, and began bombing objectives east of the Moselle River. This was done to give the impression of an impending attack on Metz, thus diverting the enemy's attention from the real point of attack. German air forces were concentrated around Metz, where aerial encounters were severe and persistent.⁴⁸

The 166th Squadron, equipped with DH 4's, was added to the 1st Day Bombardment Group but was not ready to operate before the third week in October. Meanwhile, the forces of the 96th Squadron were supplemented with enough flying teams from other squadrons to make one large formation of Bréguets. The remaining teams of the 11th and 20th

⁴⁷ John Wentworth, "Plan of Employment of Pursuit and Day Bombardment Units, First Pursuit Wing," September 25, 1918, N, Hy AS AEF, Vol. 7, pp. 231-232.

⁴⁸ Annex Number 4, Field Order Number 20, Headquarters, First Army, AEF, Ligny-en-Barrois, September 17, 1918, Department of the Army, United States Army in the World War, 1917-1919, IX, 99-100.

Squadrons made up one large DH 4 formation. In this way bombardment flights secured greater safety, for earlier missions of the offensive were carried out by formations of 12 to 18 airplanes. There had also been some improvement in flying equipment. Armored seats, more reliable machine guns, and detachable fuel tanks were provided for the Bréguets; the tanks could be released in case of enemy attack. Even with these improvements, the 1st Day Bombardment Group continued to suffer heavy losses until techniques of pursuit protection were better developed.⁴⁹

On September 18, in spite of poor visibility and heavy clouds, 17 DH 4's took off to bomb the railroad yards at Mars-la-Tour. One bomber crashed near the airfield and ten others failed to reach the objective, although five of these bombed Conflans instead. Of the six airplanes that reached Mars-la-Tour, only one came back. Three planes went down in flames when the formation was attacked by ten enemy aircraft. American planes, flying at low altitudes because of bad weather, were at a disadvantage and were easy prey for German pursuit pilots. The one plane which escaped was hidden by the clouds and mist, but was encumbered by the bombload it had not been able to drop because of failure of the bomb release mechanism. Only one enemy aircraft was shot down in the flight.

On September 26, the opening day of the Meuse-Argonne offensive, Dun-sur-Meuse was bombed by all three squadrons of the 1st Day Bombardment Group flying as one unit. As the formation approached the target

⁴⁹"Tactical History, Day Bombardment, Meuse-Argonne," 1918, D, Hy AS AEF, Vol. 1, p. 135.

it was attacked by waves of enemy pursuit aircraft. This was the first time effective cooperation had been established between American pursuit and bombardment units; while enemy planes were busy attacking the bombers, the 3d Pursuit Group, waiting above, dived on them, shooting down three of the six enemy machines destroyed during the combat and forcing the others to retire. The 20th Squadron lost five DH 4's, three of which went down in flames. In addition, two observers of the 1st Day Bombardment Group were killed; one from the 96th and one from the 20th Squadron. Airplanes of all three squadrons were damaged severely in the fighting.⁵⁰ Four and one half tons of bombs were dropped on the town and railroad yards.

On October 4, 1918, the 96th Squadron, which was leading the mission against German installations at Dun-sur-Meuse and Landres-et-St. Georges, was attacked by a pack of 30 Fokkers and Pfalzes. The 96th tightened its formation and held the Germans at a distance while the 20th and 11th Squadrons attacking from the rear shot down two enemy planes. A wild fight ensued and at its height 30 Spads of the American 2d Pursuit Group arrived according to plan and joined the fray. As a result of this engagement, the enemy lost 13 airplanes while the Americans lost only one; both of the targets were bombed.⁵¹

Bombardment units notified pursuit headquarters of their estimated time of arrival over the target and pursuit planes would

⁵⁰"Summary of Operations of 1st Day Bombardment Group: Meuse-Argonne," 1918, N, Hy AS AEF, Vol. 15, pp. 3-4.

⁵¹"Tactical History, Day Bombardment, Meuse-Argonne," 1918, D, Hy AS AEF, Vol. 1, pp. 138-139.

arrive five or ten minutes before the bombers were due, clearing the air of enemy planes and then remaining to escort the bombers back to their bases.⁵² In addition to the demoralization of the enemy, material effects of bombing raids were not inconsequential. In one attack on Bayonville, 250 troops were killed and 750 wounded. These raids invariably drew enemy pursuit from the front, making it safer for Allied observation planes to operate.

The largest Allied aerial force of the Meuse-Argonne offensive, consisting of more than 200 bombers, 100 pursuit planes, and 53 tri-place machines, was assembled on October 9, 1918. This force flew over the lines in two echelons in full view of the troops and attacked a concentration point between Wavrille and Damvillers, where the enemy was forming for a counterattack. More than 30 tons of bombs were dropped in the face of a vigorous German air attack, and the enemy counterattack failed to materialize.⁵³ During this engagement 12 enemy airplanes were shot down, while only one Allied plane failed to return. General Mitchell stated that in the 24-hour period of that day, 81 tons of bombs were dropped on all enemy targets.⁵⁴

During the Meuse-Argonne offensive French and Italian night bombardment groups bombed the airdrome at Stenay, dropping two tons of bombs on September 26, while the British night bombers hit the Fresnes

⁵² John Wentworth, "Plan of Employment of Pursuit and Day Bombardment Units, First Pursuit Wing," September 25, 1918, N, Hy AS AEF, Vol. 7, p. 236.

⁵³ Patrick, Final Report, p. 17.

⁵⁴ Mitchell, Memoirs of World War I, pp. 265-266.

airdrome with one ton of bombs on the same night.⁵⁵ The British night bombers hit Morhange airdrome with four tons of bombs on October 7, 9, and 10. The British Independent Force dropped 14 tons of bombs on the railways at Mézières, Thionville, Ars-sur-Moselle, Audun-le-Roman, and Metz during the day and night of September 26. The bombers had hard fighting over Metz and six of them failed to return. No more bombing was possible during the remaining nights of September because of bad weather. These same railways, however, were heavily bombed again in October.⁵⁶

Pursuit

About September 20, 1918, Major Bert M. Atkinson, the commanding officer of the 1st Pursuit Wing, moved his headquarters from Toul to Chaumont-sur-Aire; but operations were still carried on over the front created by the St. Mihiel battle.⁵⁷ The 1st Pursuit Group, commanded by Major Harold E. Hartney, remained on its airdrome at Rembercourt but it, too, confined its operations to the sector east of the Meuse. The 2d Pursuit Group, headed by Major Davenport Johnson, moved from Toul airdrome to Ligny-en-Barrois airdrome. The French Groupe de Combat No. 16 was relieved from duty with the 1st Pursuit

⁵⁵ Operations Report, Headquarters, First Army Air Service, September 27, 1918, in Department of the Army, United States Army in the World War, 1917-1919, IX, 143.

⁵⁶ Jones, The War in the Air, VI, 149-152.

⁵⁷ "History of the 1st Pursuit Wing Headquarters from the Time of Its Organization to the Present Date," November 18, 1918, N, Hy AS AEF, Vol. 7, p. 3.

Wing. The 1st Pursuit Wing established liaison with the other Air Service organizations and with the armies to the right and left of the First Army. In the period of preparation for the Meuse-Argonne attack the mission of pursuit aviation was to prevent enemy reconnaissance flights over the new American area. At the same time, it was important that no display of increased aerial strength be shown over the new sector. German air forces were concentrated around Conflans and from September 14 to 26 there were many severe combats.⁵⁸

During the last two months of World War I, the 1st Pursuit Wing used large forces to strafe and bomb deep in the German lines to combat the enemy's flights of low-flying battle planes. At dawn on September 26 the first sortie made by the 2d Pursuit Group destroyed eight enemy planes. A similar sortie by the 3d Pursuit Group led by its commanding officer, Major William Thaw, that same afternoon resulted in the destruction of three more German aircraft.⁵⁹

One of the most successful operations carried out by the 1st Pursuit Wing took place on October 18, 1918. Two squadrons of the 2d Pursuit Group armed with light bombs flew at a low altitude; two squadrons of the 3d Pursuit Group flew between 6,500 and 10,000 feet; all four squadrons of the 1st Day Bombardment Group flew at about 13,000 feet; and two more squadrons of the 3d Pursuit Group flew at 17,000 feet. All units met at the rendezvous at Bayonville late in

⁵⁸ Annex Number 4, Field Order Number 20, Headquarters, First Army, AEF, Ligny-en-Barrois, September 17, 1918, Department of the Army, United States Army in the World War, 1917-1919, IX, 99.

⁵⁹ "History of the 3d Pursuit Group, First Pursuit Wing, First Army," 1918, C, Hy AS AEF, Vol. 11, p. 9.

the afternoon. After the ground targets were hit, 30 or 40 enemy planes appeared. The German formation was broken up by the Allied force and at least nine enemy planes were destroyed.⁶⁰

In addition to its offensive activities, the 1st Pursuit Wing also carried on the more conventional protective patrols with observation planes, which had been provided for in the original plans for the campaign. The necessity of close cooperation with observation squadrons in carrying out these missions was emphasized. In October, observation planes landed at the airdromes of the pursuit organizations just before going out on their missions for a last-minute coordination of the flight.⁶¹

In October during the Meuse-Argonne offensive, the 185th Night Pursuit Squadron, commanded by Captain Seth Low, was assigned to the 1st Pursuit Group. Although the pilots of this squadron were not trained in night operations and the squadron's British-built Sopwith Camels were not satisfactory for night fighting, the enemy undertook few night bombardment attacks after the 185th's appearance at the front. Listening posts established along the front lines were connected by telephone and radio with anti-aircraft batteries, searchlights, and the night pursuit squadron. At night, planes from the 185th Squadron would climb to 10,000 feet, shut off their motors, and glide, watching for signal lights on the ground or anti-aircraft fire. When enemy

⁶⁰"Tactical History of American Pursuit Aviation, Meuse-Argonne," 1918, D, Hy AS AEF, Vol. 1, pp. 106-110.

⁶¹"History of the First Pursuit Wing, Meuse-Argonne," 1918, C, Hy AS AEF, Vol. 7, p. 183.

aircraft approached, the listening posts reported them to all other agencies. A barrage of fire was begun by anti-aircraft batteries and searchlight beams streaked the sky. All this was not particularly dangerous to the enemy until night pursuit planes came into action. The first night this system was in effect in the Meuse-Argonne campaign there were five combats which drove enemy planes back across their lines.⁶² No success had been achieved heretofore with the searchlights and anti-aircraft artillery alone; it must be said, however, that by this time the German bombardment aviation on the American front had become weak. On October 23, 1918, at Bar-le-Duc, an Allied searchlight focused its light on one of the four American planes, causing the pilot to make a crash landing in which he was slightly injured. The 185th combined offensive tactics with its defense against enemy night bombers, and on several occasions dropped small bombs on German command posts and troop concentrations.⁶³

By the closing months of the war, American field commanders were beginning to appreciate the morale-raising effect of aviation, and it was felt that evidence of Allied aerial supremacy would help the ground troops over the difficult terrain. Consequently, Brigadier General William Mitchell, First Army Chief of Air Service, decided to use the 1st Pursuit Group for combatting enemy battle flights and for

⁶²"Tactical History of American Pursuit Aviation, Meuse-Argonne," 1918, D, Hy AS AEF, Vol. 1, pp. 106-110.

⁶³"History of the First Pursuit Wing, Meuse-Argonne," 1918, C, Hy AS AEF, Vol. 7, pp. 181-182.

destroying balloons.⁶⁴ This type of operation, carried out on a limited scale in the St. Mihiel offensive, necessitated more dangerous low-level flights. General Mitchell thought that enemy aviation should be destroyed in full sight of advancing troops.

American innovations on the first day of the Meuse-Argonne offensive, when ten enemy balloons were shot down, took the Germans by surprise and to a certain extent upset their plan of operations. During the remainder of the offensive, few German balloons were able to function, especially those east of the Meuse.⁶⁵ Had the balloons been allowed to operate they might have been able to direct enfilading fire on advancing Allied troops.⁶⁶ The continuous harassing and destroying of German balloons by Allied pursuit forces caused the enemy to detail a protection force to patrol the front lines whenever his balloons were aloft. German planes sought to trap Allied pilots attacking balloons; this resulted in several new Allied tactics which brought down not only balloons but enemy airplanes as well.⁶⁷ Furthermore, the German diversion of planes for the protection of balloons represented a partial easing of their aerial effort against Allied observation operations.⁶⁸

⁶⁴"History of the Organization, Development, and Growth of the 1st Pursuit Group," 1918, C, Hy AS AEF, Vol. 9, p. 7.

⁶⁵Ibid.

⁶⁶Fire directed against a line of troops or other target may be delivered most effectively from a point on or near the prolongation of its longest axis. This is sometimes called raking fire.

⁶⁷Mitchell, Memoirs of World War I, pp. 253-254.

⁶⁸Telegram, to the Groups of Armies on the Western Front from German Supreme Headquarters, November 1, 1918, in Department of the Army, United States Army in the World War, 1917-1919, IX, 597.

The employment of large concentrations of pursuit was developed to a great extent in the Meuse-Argonne operations. Since the weather in France in October and November seldom permitted patrols at high altitudes, American commanders marshalled their machine and pilot resources until good weather, when they could send them all out in well-disciplined formations. These missions were conducted under the direction of competent flight leaders. Competitive spirit was developed among the flight leaders by choosing capable men to lead formations and permitting them to maneuver their forces as they chose. In this way some skillful aerial combat maneuvers were developed.⁶⁹

Balloons

Thirteen American and two French balloon companies took part in the Meuse-Argonne offensive under the command of Captain Allan P. McFarland of the American First Balloon Wing. At the opening of the Meuse-Argonne offensive the assignments of balloon companies were: with the I Corps, the 1st at Clermont-en-Argonne, 2d at Lochères, and 5th at Auzéville; with the III Corps, the 3d at Feme-de-Choisel, the 4th at Fromeréville, the 9th at Thierville, and the 42d at Bois-des-Sartelles; with the V Corps, the 6th at Ravine Jouy-en-Argonne, 7th at Bois Béthelainville, 8th in the Bois Foys (near Brabant-en-Argonne), and 12th at Jouy-en-Argonne. Assigned to artillery command posts were the 11th Balloon Company at Froméreville, 43d at Parois, 39th (French)

⁶⁹"Tactical History of American Pursuit Aviation, Meuse-Argonne," 1918, D, Hy AS AEF, Vol. 1, p. 112.

at Vraincourt, and the 93d (French) at Dobasle-en-Argonne.⁷⁰ Due to illness of their personnel, the two French balloon companies did little or nothing.

All of these companies, except the two French units, moved with the general advance, keeping between five and six miles behind the front line. In one day the 8th Balloon Company advanced 32 miles, eight miles of this distance by hand maneuvering over wrecked roads, past jammed traffic, and through woods where ragged tree limbs endangered the balloon bag and cable. Transporting an unwieldy balloon inflated with 1,000 cubic meters of highly explosive hydrogen required considerable time and energy.⁷¹

During the Meuse-Argonne campaign 21 balloons were lost, 15 burned by enemy planes and 6 destroyed by shell fire. One balloon observer made three parachute jumps within 24 hours, and two others were gas casualties.⁷² On September 26, 1918, First Lieutenant Cleo J. Ross of the 8th Balloon Company and a student observer were performing a general surveillance when their balloon was attacked by enemy planes.

⁷⁰Charles Chandler, "Report of the Balloon Section, Air Service, AEF," December 31, 1918, p. 138, in USAF HD Archives.

⁷¹On November 11, 1918, the balloon companies had advanced and were deployed in the following places: with the I Corps, the 1st Balloon Company was at Apremont, 2d at Les Petites Armoises, and the 5th at Le Besache; with the III Corps, the 3d at Montfaucon, 4th at Peuvillers, 9th at Damvillers, and the 42d at Villers-devant-Dun; with the V Corps, the 6th Company at Montfaucon, the 7th at Sasse-sur-Meuse, the 8th at Laneuville-sur-Meuse, and the 12th at Létanne; with the First Army artillery the 11th Balloon Company at Fontaines and the 43d at Nouart. Ibid.

⁷²"Balloon Operations in Offensive Combat: Meuse-Argonne," 1918, F, Hy AS AEF, Vol. 2, pp. 361-362.

They remained at their post until the balloon burst into flames; Lieutenant Ross, as senior officer, did not leave the balloon until his companion had jumped and his parachute had opened. While the balloon was falling in flames, Ross jumped and although his parachute opened, parts of the burning balloon fell on the silk canopy and destroyed it at a height of about 800 feet. Ross was dashed to the ground and killed instantly.⁷³

Balloon anti-aircraft machine gunners drove off many enemy attacks. The 6th Company brought down two enemy planes within 24 hours and the 2d Balloon Company brought down one enemy aircraft.⁷⁴ The balloon observers kept in close contact with divisional headquarters and were quite useful in directing artillery fire. Sometimes carrier pigeons were used to transmit messages, for regular telephone and radio communications were difficult to maintain with the daily re-deployment of balloon units.⁷⁵

Balloon companies confirmed the destruction of enemy planes and balloons downed by American aviators. Occasionally pilots reported that they were going up after a certain German balloon and requested that balloon observers watch for it. Their success was indicated by the fact that balloon companies reported enemy planes or balloons falling in flames or out of control just about the same number of times that the 1st and 3d Pursuit Groups made claims of victories.⁷⁶

⁷³Harry R. Stringer (ed.), Heroes All (Washington: Fassett Publishing Co., 1919), p. 340.

⁷⁴"Balloon Operations in Offensive Combat: Meuse-Argonne," 1918, F, Hy AS AEF, Vol. 2, p. 365.

⁷⁵Ibid., p. 368.

⁷⁶Ibid., pp. 361-363.

Balloon observations were made during the day, and the units advanced at night. The officers and men slept in the open, in cold and inclement weather, with only primitive shelter in the same manner as the infantry. Infantry units, however, were relieved periodically, while some balloon companies were on the front without relief throughout the Château Thierry, St. Mihiel, and Meuse-Argonne campaigns.

The Second Army

On October 12, 1918, Major General Robert L. Bullard took command of the newly organized American Second Army,⁷⁷ which was occupying the front between Fresnes-en-Woivre and Port-sur-Seille. At that time the First Army offensive in the Meuse-Argonne region had been in progress for more than two weeks, and the situation there demanded that every American division be used to the limit of its endurance. The Second Army, therefore, had to hold its front with tired divisions while they rested and prepared for another tour of duty in the Meuse-Argonne fighting. Active patrolling and raiding were continued, however, and the artillery carefully registered on targets in anticipation of a possible major offensive to be undertaken later.

Early in November it became apparent that the Allied and American attacks covering almost the entire front from the Meuse to the North Sea were producing great disorganization within the German armies. On November 5, General Pershing ordered the Second Army to

⁷⁷ The Second Army was organized on October 10, 1918. General Order Number 175, General Headquarters, American Expeditionary Forces, France, October 10, 1918.

begin advancing its lines in preparation for an offensive in the direction of Briey. The Second Army planned to launch these attacks on November 11 but on the evening of November 9 a message was transmitted from Marshal Foch, the Allied Commander-in-Chief, which directed that vigorous pressure be applied immediately all along the front.

A scarcity of troops prohibited strong concentrations but in spite of this and despite stubborn resistance encountered, the Second Army advanced, capturing about 25 square miles of French territory. Plans were completed for a combined offensive with the French, and movement towards new positions was already under way when the Armistice became effective on the morning of November 11, 1918.

The Second Army Air Service, commanded by Colonel Frank P. Lahm, consisted initially of the IV Corps Observation Group, the IV Corps Balloon Wing, the French II Colonial Corps Observation Group, and IV Corps Balloon Group.⁷⁸ The American IV Corps Observation Group, commanded by Major Harry B. Anderson, consisted of the 8th, 135th, and 168th Observation Squadrons, all using DH 4's, and was later augmented by the 258th Squadron. (The 258th, however, did not begin combat operations before the Armistice went into effect.) The newly organized 85th Squadron was assigned to the IV Corps Observation Group on November 4, 1918, and had made only two flights over the lines when its orders were revoked and it was reassigned to the Second Army

⁷⁸"Second Army Air Service," 1918, C, Hy AS AEF, Vol. 5, pp. 2-4.

Group.⁷⁹ Although hampered by bad weather, the IV Corps Observation Group successfully photographed enemy defenses; adjusted artillery fire; bombed many targets; and dropped propaganda leaflets. On November 3, eleven planes of the IV Corps Observation Group, protected by seven pursuit planes of the 4th Pursuit Group, dropped 20 bombs on Chambley. This raid was a diversionary action to assist the First Army which was then advancing. On this same mission these planes also did some low-altitude strafing of enemy positions.⁸⁰

The versatility and skill of the IV Corps Observation Group was demonstrated by the fact that it carried out visual and photographic long distance reconnaissance, conducted several bombing raids, and assisted in a number of cavalry reconnaissance patrols. During these flights planes of this organization engaged in 24 combats, during which five enemy planes and one German balloon were destroyed with a total loss to the IV Corps Observation Group of five men wounded and one killed.⁸¹

On October 22, 1918, the 8th Aero Squadron was relieved from duty with the IV Corps Observation Group and transferred to Saizerais airdrome, where it was reinforced by the 354th Squadron on October 25. These American squadrons, together with the French 28th, 47th, and 277th Squadrons, completed the VI Corps Observation Group commanded by Major

⁷⁹Leo G. Heffernan, "History of the IV Corps Observation Group," December 20, 1918, C, Hy AS AEF, Vol. 14, p. 2.

⁸⁰Ibid., p. 15.

⁸¹Summary of Operations, Air Service, Second Army, October 12-November 11, 1918, p. 2, in Jones Collection, USAF HD Archives.

Joseph McNarney. This Group began combat operations on October 27. Although the VI Corps Observation Group's aviators were less experienced than those of the IV Corps Group, they aided materially in gaining information about the enemy by both visual and photographic reconnaissance. Two adjustments of artillery fire were successfully carried out and several infantry contact patrols were completed. Bombs and propaganda leaflets were also carried by planes of this Group and dropped on enemy positions. Two combats were engaged in, during the course of which one enemy plane was destroyed. There were no combat losses but two planes of the 8th Squadron made forced landings in German territory and the crews were taken prisoner by the enemy. Subsequently the crew of one of these planes escaped and returned to the Squadron.⁸²

The French II Colonial Corps Observation Group, commanded by Major Delanney of the French Air Service, stationed at St. Mihiel air-drome, was composed of the French 28th, 47th, and 277th Observation Squadrons. All of these squadrons had had long service and effectively carried out their reconnaissance and artillery adjustment assignments. Planes from this Group engaged in four combats during which two enemy planes were shot down without loss to this organization.⁸³

The Second Army Observation Group was composed of the 85th and 278th Observation Squadrons, both equipped with DH 4's, but this

⁸²"History of the 8th Aero Squadron, 1917-1944," 1944, p. 2 in USAF HD Archives.

⁸³Summary of Operations, Air Service, Second Army, October 12-November 11, 1918, p. 2, in Jones Collection, USAF HD Archives.

Group was not organized until November 19, 1918, after the cessation of hostilities.⁸⁴

The 2d Day Bombardment Group, commanded by Major George E. A. Reinburg and consisting of the 100th and 163d Squadrons, was not formed until November 5, 1918, and did not get into operation before November 11. On October 25, the 4th Pursuit Group, commanded by Major Charles J. Biddle and composed of the 17th, 25th, 141st, and 148th Pursuit Squadrons, was organized. The 17th and 148th Squadrons had just been released by the British. Of these squadrons, the 141st was the only one to get into action before hostilities ceased.⁸⁵ The 5th Pursuit Group, used for training, was not formed until November 16, after the war was over. It was composed of the 41st, 138th, and 638th Squadrons, and was commanded by Captain D. L. Hill, who was relieved by Major Maxwell Kirby on November 25, 1918.⁸⁶

There were but four balloon companies assigned initially to the Second Army. All four of these companies were assigned to an inactive sector and did not change stations until the end of the war. The 10th Balloon Company was stationed near Dieulouard, the 15th Company near St. Baussant, the 16th near Limey, and the 69th near Nonsard. These were in the IV Corps Balloon Group commanded by Captain Paul Patterson on October 12, 1918, but they were put under the control of the Wing

⁸⁴"History of the Second Army Observation Group," 1918, C, Hy AS AEF, Vol. 8, pp. 259-262.

⁸⁵"Résumé of Second Army Air Service Operations," December 31, 1918, C, Hy AS AEF, Vol. 5, pp. 10-13.

⁸⁶"Wing and Group Headquarters Organization," 1918, A, Hy AS AEF, Vol. 6, p. 210.

Commander, Army Balloons, Second Army, Major John A. Jouett, on October 21, when that office was organized. The Second Army Balloon Wing by the end of the war included the IV Corps Balloon Group, the VI Corps Balloon Group, and the French II Colonial Corps Balloon Group. On November 3, 1918, the 10th Balloon Company was transferred from the IV Corps to the VI Corps Balloon Group which was formed on that date under the command of Captain John G. Thornell. It remained in the position it had formerly occupied, however, and carried out operations as usual.⁸⁷ The French 20th and 52d Balloon Companies under Captain Caillot made up the French II Colonial Corps Balloon Group. Artillery and student observers were given training in these balloon companies. During the Meuse-Argonne offensive, two balloons of the Second Army were destroyed by enemy aircraft; six observers were forced to jump, two of them twice in the same day.⁸⁸

⁸⁷ John H. Jouett, "History of Balloons, Second Army," 1918, F, Hy AS AEF, Vol. 1, p. 117.

⁸⁸ Ibid., pp. 115-117.

CONCLUSION

Although the initial German onslaught of World War I failed in its primary purpose of crushing France, before the close of 1914 the opposing armies had reached strategic and tactical decisions which had a decisive influence on the future course of the war. Improvised trenches running from Switzerland to the English Channel left no flanks for advancing infantry to go around. When these were reinforced with barbed wire and concrete, the war in the west became a war of attrition, one of the longest and bloodiest in history.

Their carefully planned war was . . . smashed to pieces by fire-power . . . so devastating that there was no choice but to go under the surface . . . like foxes. Then, . . . to secure these trenches from surprise, . . . each side . . . spun hundreds of thousands of miles of steel web around its entrenchments. . . . Armies, through their own lack of foresight, were reduced to the position of human cattle. They browsed behind their fences and occasionally snorted and bellowed at each other.¹

Indecisive, trench warfare still dominated the European War in April, 1917, when the United States entered the conflict. In the spring of 1918 the war of movement returned when the Germans made a series of efforts to push forward and end the war. The Allies met this attack and countered with their own offensives.

The battlefield in the First World War was dominated by artillery and machine guns--weapons which favored the defense. These powerful machines of war contributed to the peculiar patterns of this

¹ John F. C. Fuller, War and Western Civilization, 1832-1932: A Study of War as a Political Instrument and the Expression of Mass Democracy (London: Duckworth, 1932), pp. 227-228.

conflict; front lines grew to enormous lengths, battles became more protracted but less decisive. Although tanks were used in this struggle, they were few and far between and the doctrine for their employment with infantry units was not fully evolved. Shellfire severed telephone and telegraph lines, and radio was not sufficiently developed to the point that it could be depended upon for communications. The airplane had its baptism of fire in the skies over this awful battlefield.

The World War I air organizations were first and foremost collectors of information, and secondarily services of destruction. As a destructive power, they indulged in the isolated function of bomb dropping, a spectacular activity which was not as important as many people believe. Bombing in World War I was an expensive and erratic undertaking. Although elaborate plans were developed for an American bombardment program, the war ended before they could be implemented. Only 138 tons of explosives were "thrown" by American bombardiers (official records report this achievement in a more impressive manner--275,000 pounds) and there appears to be no systematic estimate of the damage that may have been caused. Since the planes employed in World War I could carry only a few bombs at a time, and these missiles weighed only 50 to 100 pounds, the damage was probably not critical.²

In the early months of World War I the aerial reconnaissance of air belligerents had been unhampered. As each side realized that

²At this point it may be well to point out that many statements presented here are not in agreement with the work of a number of competent scholars. Professor Irving B. Holley, for example, sees more in American bombardment aviation in World War I than this writer detects. Cf. Holley, Ideas and Weapons, Chap. x, especially pp. 161 ff.

enemy aerial observation units also must be obtaining useful information, hostile observation operations were deliberately interrupted in the hope of preventing the observers from making intelligence reports to their headquarters. Fast, single-seated aircraft, called chasse or pursuit planes, were employed exclusively for this purpose. Fliers were set apart to do nothing but operate these planes either as free lancers or in organized squadrons. The mission of a chasse, or fighting plane, was primarily to bring down enemy observation planes. Eventually two opposing chasse planes met and engaged in combat, not for the sake of the fight, but to clear a path for observation operations. There were a few special pursuit flights released from every duty except to find the enemy's fighters and to engage them in combat. Although they were not to trouble themselves about enemy observers, these flights were certainly there for the benefit of observation. Except for this, if a chasse plane had the choice of attacking one of its own type or an observation plane, it chose the latter. In no recorded instance did air commanders deviate from this policy. When a fighting squadron met an enemy fighting squadron conveying an observation plane or planes, it attacked the observation planes, and took the resultant skirmish with the escorts as an incidental part of harassing the observation teams.

The chasse pilot cruised about on his assigned patrol, performed a few short, sharp actions, and was through for the day; the observation team had to fly for hours at a time, frequently under continuous fire from the ground, and was always the attacked, never the aggressor. Figures show that more observers and army corps pilots

were killed or wounded than were chasse pilots. Perhaps no task was more spectacular than that of the pursuit pilot. His roving commission, and even his routine patrol, struck a chord of romantic adventure; he was first to catch the public attention. Hence, his publicity increased, and the impression arose that the Air Service was built around him. In reality, his relationship to the observer was much like that of the artillery to the infantry. He was there for protection; and protection was a secondary purpose. In his final report as Commander-in-Chief of the American Expeditionary Forces, General John J. Pershing pointed out that wars are won by the infantry and that all else in the military establishment existed only to assist the infantry.³ In the air, observation was similarly the crux of the matter and pursuit squadrons existed to chase and destroy enemy airplanes in order that observers might continue their work unmolested.

Aerial combat purely as an expression of military power is absurd. It has no greater significance, per se, than the maneuvering of two wily snipers, each of whom hides in his own lines and tries to stop the other. A single fighting plane, from a tactical or strategic standpoint, is of little importance; and a battle between two opposing single-seaters would be virtually of no consequence unless the victory of one over the other had a bearing upon the greater operations of opposing armies. In World War I the only reasons for the existence of chasse planes were to prevent the enemy from gathering information and to provide assistance to aerial observation units.

³ John J. Pershing, Final Report of the Commander-in-Chief, American Expeditionary Forces (Washington: Government Printing Office, 1919), p. 27.

Captain Edward V. Rickenbacker, the leading American Ace and perhaps the best-known Air Service figure to emerge in World War I, was convinced of the paramount significance of observation aviation.

Although he flew with and later commanded a pursuit unit, he wrote:

I believe this function of 'seeing for the army' is the most important one that belongs to the aviation arm in warfare. Bombing, patrolling, and bringing down enemy aeroplanes are but trivial compared to the vast importance of knowing the exact positions of the enemy's forces. . . .⁴

Ideally, the observer's pilot should have been a man even more perceptive than the chasse pilot. Pilot and observer bunked together, flew together, fought together, and if they ran out of luck they often died together. When one was ill, the other usually was relieved from duty. They constituted a crew which demanded superb teamwork. Their reactions, their judgments, their decisions in the air had to be as carefully coordinated as the fixed machine guns which were synchronized with the propeller. The chasse pilot flew alone, fought alone, and in case of mishap had no one to think about and no one to blame but himself. To be sure, all three types of fliers had to be able to react quickly, but only in observation operation teams was such a high level of mutual confidence necessary. Georges Guynemer, perhaps France's most famous Ace and one who made a legend of personal daring in chasse combats, said:

What I must tell you is the courage of the observers. When we stop to think that these officers deliver up their lives to a pilot who may make one mistake, be the victim of a moment of dizziness, or of a fainting fit, or even of a mortal wound . . . we cannot admire them too much. I admit that I would not like their profession. I am not afraid, but I accept that danger against

⁴Rickenbacker, Fighting the Flying Circus, p. 128.

which I can fight, while the observer has to have blind confidence in his pilot. I assure you that an observer . . . has deserved well of his country.⁵

The average observation machine was exposed to direct fire many more times and experienced much more actual combat than the average pursuit plane. Moreover, the observation machine flew frequently at low altitudes and under weather conditions which kept chasse pilots on the ground. The two American pursuit squadrons which fought the greatest number of combats were the 94th (to which Aces Eddie Rickenbacker, Douglass Campbell, and James Meissner belonged) and the 13th; they averaged 97 combats apiece. The two leading observation squadrons, the 1st and the 91st, averaged 102 combats apiece.⁶ In addition to Captain William P. Erwin, there were four other American Aces who were observation pilots; all of these officers served in the 91st Squadron. In actions incidental to its regular duty, this observation unit brought down 21 enemy planes.⁷ In the Allied air services more than 50 Aces were observation pilots.

During the early part of the European War, the belligerents tried to use one type of airplane for all kinds of operations, but this soon gave way to specialization. By the end of the war there were three branches of aviation: pursuit, bombardment, and observation. All of these branches more or less depended on each other; neither

⁵ Jacques Mortane, Guynemer, the Ace of Aces, trans. Clifton Harby Levy (New York: Moffat, Yard and Co., 1918), p. 137.

⁶ The 1st Aero Squadron engaged in 65 combats and the 91st in 139. "History of the 1st Aero Squadron," 1918, E, Hy AS AEF, Vol. 1, p. 179; "History of the 91st Aero Squadron, 1917-1934," p. 3, in USAF HD Archives.

⁷ Ibid.

observation nor bombardment could function unless it was protected against enemy pursuit. In a given operation, it was necessary for each branch to know what the others were doing, so that if they could not operate over all parts of the line, they could concentrate on the most important points. In the event of a rapid advance, all aviation units had to be notified of changes in troop position, because they might shoot and bomb their own troops instead of attacking the enemy's artillery, infantry, or trains bringing up reinforcements and supplies. In the face of strong enemy opposition all branches of aviation had to act in conjunction with one another.

The United States had little to do with the development of air doctrine in World War I. She merely followed the patterns of the Allies who were competing with the Germans in the skies over western Europe. The invention of the fixed machine gun synchronized to fire through the propeller and the development of formation flying revolutionized the aerial war. In spite of the fact that no official American air doctrine per se was drawn up, a tactical air doctrine was developed by the United States Air Service during World War I. Doctrine and practice in observation flying developed relatively simply and harmoniously, but this was not the case with pursuit and bombardment aviation. By the end of the war most American plans for employing aeronautics were slanted toward support of ground troops.

When an operation was projected, a plan of aerial employment was drawn up by the commander of the Air Service, submitted to the commanding general, and published in the form of orders. The plan of employment usually provided for three stages of operations:

preliminary, attack, and exploitation. In the preliminary stage it was necessary to find out everything possible about the enemy by photographic and visual reconnaissance. At the same time an aerial barrage had to be kept up against enemy surveillance in order to prevent his gaining information about Allied concentrations, particularly at night when most movements occurred. Camouflage such as dummy airdromes and planes was used extensively. In the attack phase the Air Service attempted to destroy hostile targets such as airdromes, aircraft, artillery, and troop concentrations. The activities required penetration of the enemy's lines as well as the employment of pursuit planes for protection. Only about one third of the total number of aircraft available could be in the air at a given time, for planes were forced to land every two to four hours for refueling, and a reserve had to be maintained to meet emergencies. In the exploitation phase, airplanes attacked the most vulnerable and dangerous enemy targets: concentrations of supplies; communications, particularly railroads and bridges; and cities which had been converted to military use. These bombardment raids had to be protected by pursuit escorts.

The plan of employment was supplemented by a complete plan of reconnaissance designed to show what must be learned about the enemy. Aerial observation teams cooperated with military intelligence: reporting, analyzing, and recommending the targets to be attacked; noting signs of enemy counterattacks; and suggesting routes best suited for movements.

One of the unfortunate results of the First World War, as far as the United States is concerned, appears to have been an unmerited

sense of accomplishment. Modesty in military affairs has never been one of America's characteristics, yet more than once America has asked a large number of men to spring to arms overnight, and then to wait six months for the arms. After their entrance into the war "to make the world safe for democracy," Americans began praising themselves for a feat which they never accomplished; this self-adulation began even before the United States had done anything but make plans. While Liberty engines were still cracking as fast as they could be set up on the testing block, Americans were telling one another that the Liberty was infinitely better than the Rolls Royce and the greatest single achievement of the war.⁸ The United States supplied morale and money to its Allies, and on the day of the Armistice it had almost two million men in Europe,⁹ but few American troops actually participated in more than a few days' fighting. The United States supplied virtually no guns, no ammunition, and only a few airplanes; yet it spent a million dollars an hour while it was at war.¹⁰

Testifying before a congressional committee investigating the Air Service, Major General Mason M. Patrick, the former Chief of Air Service, American Expeditionary Forces, stated that France, with 1,500,000 men at the front, had 3,321 planes of all descriptions in operation; that England, with 900,000 men at the front, had 1,758 planes; and that the United States, with 1,250,000 men at the front,

⁸New York Times, December 22, 1917, p. 11.

⁹Ayres, The War With Germany: A Statistical Summary, p. 15.

¹⁰Ibid., p. 131.

had just 740 planes in operation, most of them borrowed planes at that.¹¹ To have been adequately equipped, General Patrick testified, the American forces should have had 3,400 serviceable planes.¹²

Some "official" figures claim that the United States produced over 8,000 planes by November, 1918.¹³ The Air Service could fight, observe, and bomb with only the 740 at the front.¹⁴ The report should have pointed out that this total included 3,000 condemned Bristols, J 1 training planes, and other obsolete aircraft. As a matter of fact, France actually had a fleet of over 30,000 airplanes; many of them in reserve, additional aircraft undergoing repairs, and others still at the factories. Altogether, the American Air Service procured about 2,500 planes from France and 200 from Britain. Of this total 527 were still serviceable on the 11th of November.¹⁵

According to the records, American pilots shot down 753 enemy airplanes and 71 enemy balloons; no distinction was made between the two as far as victory credits were concerned. All of these were officially confirmed, but it should be noted that credit for one enemy

¹¹ On October 31, 1918, there were 17 American observation squadrons at the front; 11 of them were equipped with Salmson airplanes acquired from France, 5 with DH 4's, and 1 with Bréguets, another French model. That is, 12 of these squadrons, even at this late date, were equipped with French aircraft.

¹² U.S., Congress, House, Hearings Before Subcommittee No. 1 (Aviation) of Select Committee on Expenditures in the War Department, 66th Cong., 1st Sess., 1919, p. 374.

¹³ Ayres, The War With Germany: A Statistical Summary, p. 100.

¹⁴ Patrick, Final Report, p. 3.

¹⁵ Ayres, The War With Germany: A Statistical Summary, pp. 87-90.

aircraft destroyed was given to each person who took part in downing it. The Americans lost 357 airplanes and 35 balloons to the Germans in air battles.¹⁶ American squadrons flew 35,000 hours over the lines and took 18,000 photographs of enemy positions, from which 585,000 prints were made by photographic sections attached to the observation groups. Artillery fire was regulated, infantry contact patrols were flown, and enemy batteries, convoys, and troops on the march were machine gunned and bombed by these American squadrons.

By the end of hostilities, 35 American balloon companies with a strength of 446 officers and 6,365 men were in France: of these, 23 companies were serving at the front. American Expeditionary Forces balloons made 642 ascensions and were in the air 3,111 hours. They made 316 artillery adjustments, reported 12,018 shell bursts, and sighted 11,856 enemy airplanes. They reported enemy balloon ascensions 2,649 times, enemy batteries 400 times, enemy traffic on roads and railroads 1,113 times, and explosions and destructions 597 times.¹⁷

Some Americans have charged that the airplanes which France loaned and sold to the American Air Service were either obsolete or obsolescent; that the French ships were inferior to the poorest of the German craft, hardly safe to fly at all. As a matter of fact, France made possible the participation of the American Air Service in World War I. Perhaps it was to her advantage to do so; at any rate, America's airplane program, ridiculously advertised, amounted to little and the warring nations knew it. General Pershing, in his final official report, said that:

¹⁶Patrick, Final Report, p. 3.

¹⁷Ibid., p. 3.

In aviation we were entirely dependent upon our Allies. From time to time we obtained from the French flying corps such planes as they could provide. Without going into a complete discussion of aviation matériel, it will be sufficient to state that it was with great difficulty that we obtained equipment even for training. As for up-to-date combat planes, the development at home was slow, and we had to rely on the French, who provided us with a total of 2,676 pursuit, observation, and bombing machines. The first American squadron, completely equipped by American production, including aeroplanes, crossed the German lines on August 7, 1918.¹⁸

These American airplanes were DH 4's, considered obsolete in England even while they were being brought into production in the United States. They were glaringly unfitted for use as combat planes, and only fair for employment as observation craft.

France loaned and sold airplanes which were not the best; for example, the French provided Americans with Nieuport pursuit planes, while their own pilots were flying Spads, and for observation they delivered Avion Renaults, which were actually their old training aircraft.¹⁹ Should they have given up their Spads? There was no reason for France to cripple her own efficiency in order to heighten America's. The French offered the best they could spare, and Americans were lucky to be associated with a nation whose second-best ships were as good as Nieuports. To be sure, Nieuports often shed their wing fabric on a long, fast dive, and their ceiling (the limit of altitude which they could reach) was comparatively low, but they were as maneuverable as any airship made, and they served so much better than

¹⁸ Pershing, Final Report of the Commander-in-Chief, American Expeditionary Forces, p. 76.

¹⁹ Guynemer reportedly said that if the Germans had used such poor aircraft he would have guaranteed to shoot down one a day. Falls, The Great War, p. 371.

anything America ever put into production that criticism is rather out of place.

France did the best she could for the United States. The Salmsons and Bréguets supplied for observation were first-rate ships; American observers preferred them to the nose-heavy and wing-heavy DH 4's with the Liberty engine.²⁰ French fliers gave instruction to trained but inexperienced American personnel. Meanwhile, the American Air Service was doing such extraordinary things as sending the 95th Aero Squadron to the front without planes or a bit of equipment and before its pilots had been instructed in aerial gunnery. The 95th was kept at the front utterly impotent for six weeks. Planes finally arrived, but they were not armed with machine guns. Captain John Miller of this Squadron lost his life on his first flight over enemy lines.²¹ Then the pilots went to the gunnery school at Cazaux, learned how to shoot, returned to the front in a month, and made a splendid record. This episode, which took place in a turbulent war zone, was a waste of energy and personnel. For every similar piece of administrative inefficiency at the front there were many more in the United States.

When the Armistice was signed the Air Service had 744 pilots, 457 observers, and 23 aerial gunners, all completely trained: a total of 1,224 fliers at the front.²² There were also 7,726 officers and

²⁰ A flight commander in the 24th Aero Squadron based his criticisms of the DH 4 observation plane on experience. Sidney V. W. Peters, "The Liberty DH 4," December 23, 1918, A, Hy AS AEF, Vol. 15, p. 215.

²¹ Morris and Smith, Ceiling Unlimited, p. 174.

²² Patrick, Final Report, p. 3. An additional 216 American

70,769 enlisted men (including 20,000 training in England) in the Air Service. In spite of Allied appeals for more men, the American Air Service had trained and sent to the front only 457 observers by the end of the war. Even if more observers had been available, they would not have been able to fly, for there were insufficient planes. The collapse of the American aircraft production program is too well known to need an elaborate exposition here. The American public was told that over 5,000 pilots and observers had been sent to join the American Expeditionary Forces²³ but the public did not realize that hardly a quarter of these 5,000 men were actually flying.

Individually the American flier was often brave. If he had not been brave he would never have discounted, for example, the shortsightedness of his commanders, who let him go out on patrol duty over the lines without a machine gun on his plane. The guns of the 94th Aero Squadron were late in arriving, and pilots flew without them; they would have been defenseless had they been attacked. Luck was with them; in a solid fortnight not one member of the Squadron met a German plane.²⁴

Of the 14 nations which engaged in battles in the First World War, the United States stood twelfth in combat losses, topping only Greece and Portugal. The eleventh nation, Bulgaria, lost twice as

pilots were serving in the British Royal Air Force; 65 Americans were assigned to Italian units. Ibid., p. 8.

²³New York Times, November 16, 1918, p. 2.

²⁴Hinton, Air Victory: The Men and Machines, p. 28.

many men as America did.²⁵ For each 1,000 American officers who reached France the following ratio of officers of the different arms were killed in battle: infantry, 80.5; aviation, 33.3; engineers, 11.5; tank corps, 11.5; artillery, 8.1; and signal corps, 3.8.²⁶ In the second most perilous of all military employment (infantry was by far the most hazardous), the United States lost (killed in combat at the front) only 205 of the entire Air Service personnel in the American Expeditionary Forces.²⁷ There were 184 pursuit pilots who became casualties (killed, wounded, and missing) as against 150 observers and 105 observation pilots.²⁸ American fliers were in combat for about ten months and averaged about 34 casualties per month for the actual period of warfare. France with a total of 3,872 pilots and observers killed, 2922 wounded, and 1,461 missing,²⁹ was in the war for 51 months and lost an average of 157 fliers per month. The Germans lost 5,904 fliers in battle and 1,962 in training.³⁰ Britain, France, and Germany each averaged about 4,500 flying officers killed in action.³¹ The United States lost 205.

Actually, aerial service was not any less hazardous than the newspapers maintained, nor was the aviator's skill so superhuman that

²⁵ Ayres, The War With Germany: A Statistical Summary, p. 139.

²⁶ Ibid., p. 121.

²⁷ An additional 89 American officers and men who were attached to the British, French, and Italian forces were also killed.

²⁸ Edgar S. Gorrell, The Measure of America's World War Aeronautical Effort (Northfield, Vt.: Norwich University, 1940), p. 38.

²⁹ Ibid., p. 41.

³⁰ Ibid., p. 42.

³¹ Ibid., pp. 41-43.

he won easy victories; but the Air Service performed, comparatively, so little work that the total casualties were few. American fliers were so inadequately prepared, however, that the percentage of casualties was inordinately high. Only 205 American fliers were killed in action because the United States had barely begun to participate in aerial warfare. The American Air Service lost these men three or four times as fast as any other nation lost them at the front in 1918. American fliers were not afraid to fight: they were simply too late. In speaking of actual American achievements in the air, one is compelled to fall back upon sweeping generalizations, upon the work of half a dozen squadrons, upon the accomplishments of a scattering of individuals in the St. Mihiel and Meuse-Argonne offensives.

The American Air Service expanded its forces and operations during the spring and summer of 1918. During the Château Thierry counteroffensive, a critical turning point in the war, the American air strength had grown to allow participation by four pursuit and three observation squadrons. The rate of expansion thereafter accelerated. By September, General Pershing had won his bitter battle with the Allies for a distinctive American effort in the war.

Entrusted with the task of eliminating the St. Mihiel salient, American Expeditionary Forces were augmented by five French divisions. British and French squadrons supplemented the American Air Service. A total of 1,500 aircraft, an unprecedented number for the war's duration, was placed under the command of General Mitchell and was concentrated on bases around the enemy-held salient. Only about 300 planes of this total represented American air units; the majority of

these were flown by inexperienced aviators. Bad weather during the first two days of the four-day offensive interfered with air operations. When the planes could fly, Allied domination of the air was overwhelming, but at no time were the 1,500 planes in the air simultaneously, nor were any large numbers concentrated in mass flights. Soon after the American advance halted, most of the Allied units were recalled by their respective commanders.

At a critical phase in the Meuse-Argonne offensive, aerial observers discovered a vast concentration of German units. To meet this threat, on October 9, 1918, the war's greatest show of airpower took place. It was almost entirely an American effort; more than 350 planes, two thirds of them armed with bombs, struck the enemy and thwarted his plans for a massive counterattack. German fighters which arose to oppose this massive force were shot down or driven off. In other Allied operations conducted that same day, several enemy targets received an unprecedented number of bombs.³²

The First World War is not of much interest to present-day Americans; discounting the unmuted trumpets of the American Legion, it never has been. Perhaps it was due to the disillusionment which followed the failure to attain the idealistic, even moralistic, war goals. More likely, the Second World War and the Korean experience, coupled with a tacit recognition of the problems of new types of warfare, have heightened this disinterest.

³² The big concentration of planes on air bases for the St. Mihiel action and the later mass formation in a single offensive action during the Meuse-Argonne campaign, both commanded by Brig. Gen. William Mitchell, are often confused by historians and other writers.

War in the twentieth century has followed a trend toward mechanization and the increased size of armies; toward the militarization of the entire population and the nationalization of war effort; and toward the intensification of military operations. This evolution of war has been directed to what Quincy Wright has called the "totalitarianization of war."³³ The role of the civilian in time of war has become much closer to that of the soldier. Weapons of mass destruction--improved means to unimproved ends--have blurred the distinction between battlefield and homefront.

The American has always regarded war as a sort of aberration, an unnatural state of affairs. Yet the history of the United States has been molded by the wars she has fought, even in the way in which they have been waged. Traditionally, the American has been reluctant to engage in open hostilities. Once the decision to fight was made, however, an all-out effort was unleashed. The citizen-soldier grabbed his weapon and in short order defeated the nation who disturbed his peace. Unfortunately, the United States approached World War I without recognizing changes in the nature of warfare and the necessity of adjusting to meet the new developments.

Looking back at the American military participation in World War I, one is tempted to render severe criticism of a nation which made so many mistakes by preparing for war only when fighting it. The story of the Air Service in World War I abounds in lost opportunities sprinkled with a handful of genuine accomplishments. It is easy from

³³ Quincy Wright, A Study of War (Chicago: University of Chicago Press, 1942), I, 330 ff.

hindsight to pick out these errors. At the time the leaders thought they were doing what was best. Can we be assured that history will judge our present-day decisions as being as wise as we have found those of an earlier era?

Finally, it is impossible to study the American Air Service in the European War without realizing some impression of the human drama which permeates this entire experience. All of the story of the Air Service is not found in the decisions of commanders or even in the brave deeds of fliers. The mass of documents cannot hide the optimism, frustration, anxiety, despair, and even boredom which was the lot of most Americans who served in the war.

APPENDICES

APPENDIX I

SPECIFICATIONS OF ALLIED AIRPLANES*

TYPE	ENGINE	WEIGHT	DIMENSIONS	ARMAMENT	PERFORMANCE
Bréguet 14 (two-seat reconnaissance and day bomber)	300 hp Renault	<u>Empty</u> 2,222 lb <u>Loaded</u> 3,380 lb	<u>Span</u> 47 ft 3 in <u>Length</u> 29 ft 7 in <u>Height</u> 10 ft 9 in	<u>Machine Guns</u> 1 fixed 2 movable <u>Bombs</u> 660 lb	<u>Max. Speed</u> 115 mph at sea level <u>Climb</u> 16,400 ft in 47 min <u>Ceiling</u> 18,900 ft <u>Endurance</u> 4 hr 45 min
Bristol F 2B (two-seat reconnaissance and fighter airplane)	200 hp Sunbeam	<u>Empty</u> 1,745 lb <u>Loaded</u> 2,590 lb	<u>Span</u> 39 ft 4 in <u>Length</u> 26 ft 2 in <u>Height</u> 10 ft 1 in	<u>Machine Guns</u> 1 fixed 2 movable <u>Bombs</u> 60 lb	<u>Max. Speed</u> 125 mph at sea level <u>Climb</u> 5,000 ft in 5 min <u>Ceiling</u> 20,000 ft <u>Endurance</u> 3 hr
Caproni CA 33 (three heavy bomber)	190 hp Isotta Fraschini	<u>Empty</u> 7,700 lb <u>Loaded</u> 8,752 lb	<u>Span</u> 73 ft 6 in <u>Length</u> 36 ft 1 in <u>Height</u> 12 ft 7 in	<u>Machine Guns</u> 5 movable <u>Bombs</u> 880 lb	<u>Max. Speed</u> 84 mph at 6,500 ft <u>Climb</u> 6,500 ft in 24 min <u>Ceiling</u> 16,400 ft <u>Endurance</u> 6 hr

*Based on information in Owen G. Thetford and E. J. Riding, Aircraft of the 1914-1918 War (Marlow, Eng.: Harleyford Publications, 1954).

APPENDIX I: Continued

TYPE	ENGINE	WEIGHT	DIMENSIONS	ARMAMENT	PERFORMANCE
Caudron G 3 (two-seat reconnaissance and trainer)	80 hp Gnome	<u>Empty</u> 981 lb <u>Loaded</u> 1,619 lb	<u>Span</u> 43 ft 5 in <u>Length</u> 22 ft 6 in <u>Height</u> 8 ft 5 in	<u>Machine Guns</u> 1 movable	<u>Max. Speed</u> 71 mph at sea level <u>Climb</u> 6,500 ft in 20 min <u>Ceiling</u> 10,000 ft <u>Endurance</u> 4 hr
De Havilland 4 (two-seat day bomber)	375 hp Rolls Royce	<u>Empty</u> 2,403 lb <u>Loaded</u> 3,472 lb	<u>Span</u> 42 ft 6 in <u>Length</u> 30 ft <u>Height</u> 11 ft	<u>Machine Guns</u> 1 fixed 2 movable <u>Bombs</u> under wings	<u>Max. Speed</u> 137 mph at 6,500 ft <u>Climb</u> 5,000 ft in 5 min <u>Ceiling</u> 22,000 ft <u>Endurance</u> 3 hr 45 min
Farman F 20 (two-seat reconnaissance)	(two) 80 hp Gnome	<u>Empty</u> 820 lb <u>Loaded</u> 1,440 lb	<u>Span</u> 44 ft 9 in <u>Length</u> 26 ft 6 in <u>Height</u> 12 ft	<u>Machine Guns</u> 1 movable	<u>Max. Speed</u> 60 mph at sea level <u>Climb</u> 3,000 ft in 19 min <u>Endurance</u> 3 hr
Le Pere (two-seat reconnaissance)	425 hp Le Pere	<u>Empty</u> 2,562 lb <u>Loaded</u> 3,746	<u>Span</u> 41 ft 7 in <u>Length</u> 25 ft 3 in <u>Height</u> 9 ft 6 in	<u>Machine Guns</u> 2 fixed 2 movable	<u>Max. Speed</u> 133 mph at 6,500 ft <u>Climb</u> 6,500 ft in 6 min <u>Ceiling</u> 21,500 ft <u>Endurance</u> 2 hr 40 min
Morane (two-seat corps reconnaissance)	110 hp Le Rhône	<u>Empty</u> 952 <u>Loaded</u> 1,612 lb	<u>Span</u> 36 ft 9 in <u>Length</u> 23 ft 7 in <u>Height</u> 11 ft 5 in	<u>Machine Guns</u> 1 fixed	<u>Max. Speed</u> 96 mph at 6,500 ft <u>Climb</u> 10,000 ft in 15 min <u>Ceiling</u> 15,000 ft

APPENDIX I: Continued

TYPE	ENGINE	WEIGHT	DIMENSIONS	ARMAMENT	PERFORMANCE
✓ Nieuport 28 (single-seat scout)	160 hp Gnome	<u>Empty</u> 953 lb <u>Loaded</u> 1,636 lb	<u>Span</u> 26 ft 9 in <u>Length</u> 20 ft 3 in <u>Height</u> 7 ft	<u>Machine Guns</u> 2 fixed	<u>Max. Speed</u> 140 mph at sea level <u>Climb</u> 16,350 ft in 20 min <u>Ceiling</u> 19,000 ft
Salmson 2A2 (two-seat reconnaissance and day bomber)	260 hp Salmson	<u>Empty</u> 1,668 lb <u>Loaded</u> 2,870 lb	<u>Span</u> 38 ft 6 in <u>Length</u> 27 ft 9 in <u>Height</u> 9 ft 6 in	<u>Machine Guns</u> 1 fixed 2 movable <u>Bombs</u> 500 lb	<u>Max. Speed</u> 116 mph at sea level <u>Climb</u> 16,500 ft in 27 min
✓ S. E. 5 (single-seat scout)	150 hp Hispano-Suiza	<u>Empty</u> 1,399 lb <u>Loaded</u> 1,930 lb	<u>Span</u> 28 ft <u>Length</u> 21 ft 4 in <u>Height</u> 9 ft 5 in	<u>Machine Guns</u> 2 fixed	<u>Max. Speed</u> 119 mph at 6,500 ft <u>Climb</u> 6,500 ft in 8 min <u>Ceiling</u> 17,000 ft <u>Endurance</u> 2 hr 30 min
✓ Sopwith Fl (Camel) (single-seat scout)	110 hp Le Rhône	<u>Empty</u> 889 lb <u>Loaded</u> 1,422 lb	<u>Span</u> 28 ft <u>Length</u> 18 ft 8 in <u>Height</u> 8 ft 6 in	<u>Machine Guns</u> 2 fixed	<u>Max. Speed</u> 118 mph at 6,500 ft <u>Climb</u> 10,000 ft in 17 min <u>Ceiling</u> 24,000 ft <u>Endurance</u> 2 hr 45 min
Sopwith 5Fl (Dolphin) (single-seat scout for high-altitude fighting)	200 hp Hispano-Suiza	<u>Empty</u> 1,391 lb <u>Loaded</u> 2,000	<u>Span</u> 32 ft 6 in <u>Length</u> 22 ft 3 in <u>Height</u> 8 ft 6 in	<u>Machine Guns</u> 2 fixed 2 movable	<u>Max. Speed</u> 132 mph at 6,500 ft <u>Climb</u> 6,500 ft in 6 min <u>Ceiling</u> 21,000 ft <u>Endurance</u> 2 hr 20 min

APPENDIX I: Continued

TYPE	ENGINE	WEIGHT	DIMENSIONS	ARMAMENT	PERFORMANCE
Spad A 2 (two-seat reconnaissance)	235 hp Hispano- Suiza	<u>Empty</u>	<u>Span</u>	<u>Machine Guns</u>	<u>Max. Speed</u>
		1,485 lb	36 ft 8 in	1 fixed	110 mph at
		<u>Loaded</u>	<u>Length</u>	1 movable	10,000 ft
		2,310 lb	25 ft 4 in	<u>Bombs</u>	<u>Climb</u>
			<u>Height</u>	light bombs	10,000 ft
			8 ft 5 in	under wings	in 13 min
					<u>Ceiling</u>
					20,000 ft
					<u>Endurance</u>
					2 hr 20 min
Spad S 7 (single-seat scout)	205 hp Hispano- Suiza	<u>Empty</u>	<u>Span</u>	<u>Machine Guns</u>	<u>Max. Speed</u>
		1,177 lb	25 ft 8 in	1 fixed	119 mph at
		<u>Loaded</u>	<u>Length</u>		6,500 ft
		1,632 lb	20 ft 3 in		<u>Climb</u>
			<u>Height</u>		15,000 ft
					in 25 min
					<u>Ceiling</u>
					20,000 ft
					<u>Endurance</u>
					2 hr 30 min
Voisin (two-seat reconnaissance and night bomber)	140 hp Salmson	<u>Empty</u>	<u>Span</u>	<u>Machine Guns</u>	<u>Max. Speed</u>
		2,090 lb	48 ft 5 in	1 fixed	62 mph at
		<u>Loaded</u>	<u>Length</u>	<u>Aerial Cannon</u>	6,500 ft
		2,959 lb	31 ft 3 in	1 47 mm	<u>Climb</u>
			<u>Height</u>		6,500 ft
			9 ft 8 in		in 25 min
					<u>Ceiling</u>
					10,000 ft
					<u>Endurance</u>
					4 hr

APPENDIX II

SPECIFICATIONS OF GERMAN AIRPLANES*

TYPE	ENGINE	WEIGHT	DIMENSIONS	ARMAMENT	PERFORMANCE
Albatros D 1 (single-seat scout)	160 hp Mercedes	<u>Empty</u> 1,485 lb <u>Loaded</u> 1,903 lb	<u>Span</u> 28 ft 3 in <u>Length</u> 24 ft <u>Height</u> 9 ft 6 in	<u>Machine Guns</u> 2 fixed	<u>Max. Speed</u> 110 mph at sea level <u>Climb</u> 6,500 ft in 7 min
Fokker D 7 (Biplane) (single-seat scout)	160 hp Mercedes	<u>Empty</u> 1,540 lb <u>Loaded</u> 1,936 lb	<u>Span</u> 29 ft 3 in <u>Length</u> 23 ft <u>Height</u> 9 ft 3 in	<u>Machine Guns</u> 2 fixed <u>Bombs</u> <u>Bomb racks</u> rarely fitted	<u>Max. Speed</u> 120 mph at sea level <u>Climb</u> 16,405 ft in 38 min
Fokker Dr 1 (Triplane) (single-seat scout)	110 hp Oberursal	<u>Empty</u> 829 lb <u>Loaded</u> 1,259 lb	<u>Span</u> 23 ft 7 in <u>Length</u> 19 ft <u>Height</u> 9 ft	<u>Machine Guns</u> 2 fixed	<u>Max. Speed</u> 121 mph at 8,000 ft <u>Climb</u> 10,000 ft in 6 min <u>Ceiling</u> 20,000 ft <u>Endurance</u> 2 hr 30 min
Gotha G 5 (heavy day and night bomber)	(two) 260 hp Mercedes	<u>Empty</u> 6,039 lb <u>Loaded</u> 8,863 lb	<u>Span</u> 77 ft 8 in <u>Length</u> 40 ft 9 in	<u>Machine Guns</u> 3 movable <u>Bombs</u> 14 bombs in fuselage 2 bombs under wings	<u>Max. Speed</u> 87 mph at sea level <u>Ceiling</u> 21,300 ft <u>Endurance</u> 4 hr

*Based on information in Owen G. Thetford and E. J. Riding, Aircraft of the 1914-1918 War (Marlow, Eng.: Harleyford Publications, 1954).

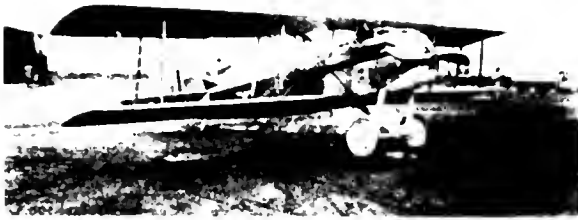
APPENDIX II: Continued

TYPE	ENGINE	WEIGHT	DIMENSIONS	ARMAMENT	PERFORMANCE
Halberstadt C 2 (two-seat fighter, reconnaissance, and attack airplane)	180 hp Mercedes	<u>Empty</u> 2,532 lb <u>Loaded</u> 3,077 lb	<u>Span</u> 35 ft 3 in <u>Length</u> 24 ft <u>Height</u> 9 ft 6 in	<u>Machine Guns</u> 1 fixed 1 movable <u>Bombs</u> hand grenades	<u>Max. Speed</u> 97 mph at 10,000 ft <u>Climb</u> 5,000 ft in 9 min <u>Ceiling</u> 13,500 ft
L. V. G. C 5 (two-seat reconnaissance and short- range day bomber)	225 hp Benz	<u>Empty</u> 2,138 lb <u>Loaded</u> 3,141 lb	<u>Span</u> 44 ft 9 in <u>Length</u> 26 ft 8 in <u>Height</u> 10 ft 4 in	<u>Machine Guns</u> 1 fixed 1 movable <u>Bombs</u> a few light bombs	<u>Max. Speed</u> 110 mph at sea level <u>Climb</u> 6,500 ft in 22 min
Pfalz D 3 (single-seat scout)	180 hp Mercedes	<u>Empty</u> 1,532 lb <u>Loaded</u> 2,056 lb	<u>Span</u> 30 ft 9 in <u>Length</u> 23 ft 2 in <u>Height</u> 8 ft 8 in	<u>Machine Guns</u> 2 fixed	<u>Max. Speed</u> 103 mph at sea level <u>Climb</u> 10,000 ft in 17 min <u>Ceiling</u> 17,500 ft <u>Endurance</u> 2 hr 30 min
Rumpler C 5 (two-seat reconnaissance)	260 hp Mercedes	<u>Empty</u> 2,439 lb <u>Loaded</u> 3,439 lb	<u>Span</u> 41 ft 6 in <u>Length</u> 26 ft 9 in <u>Height</u> 9 ft 9 in	<u>Machine Guns</u> 1 fixed 1 movable <u>Bombs</u> 6 bombs	<u>Max. Speed</u> 101 mph at 10,000 ft <u>Ceiling</u> 22,000 ft <u>Endurance</u> 4 hr

APPENDIX III

PICTURES OF AIRPLANES

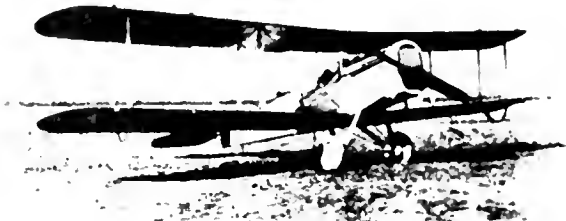
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SPAD TWO SEATER



LEPERE



DEHAVILAND-4



BREGUET



FARMAN



CAPRONI

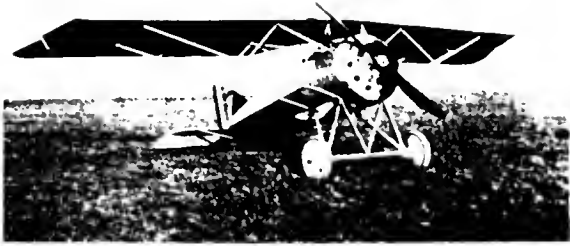


VOISIN



CAUDRON

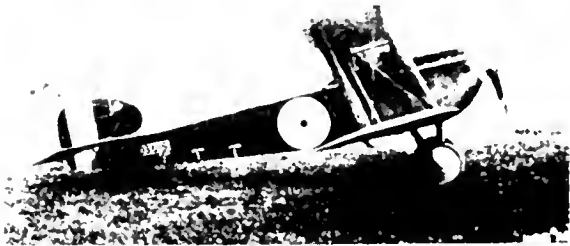
Figure 1. Allied Aircraft Used in World War I



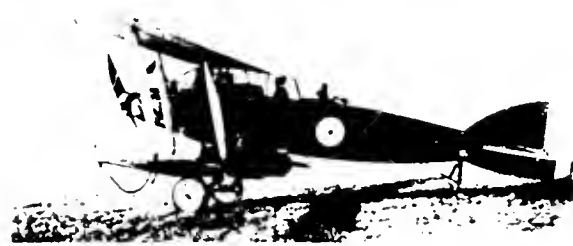
MORANE



SPAD



SOPWITH DOLPHIN



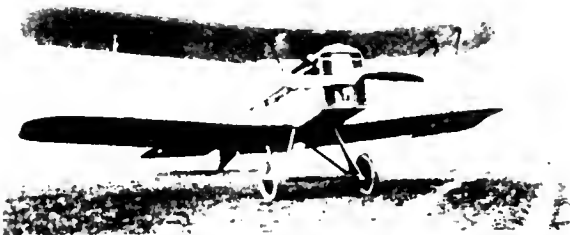
BRISTOL FIGHTER



NIEUPORT



SOPWITH CAMEL



S. E. 5

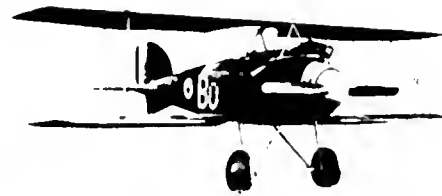


SALMSON

Figure 2. Allied Aircraft Used in World War I



FOKKER TRIPLANE



ALBATROS



FOKKER BIPLANE



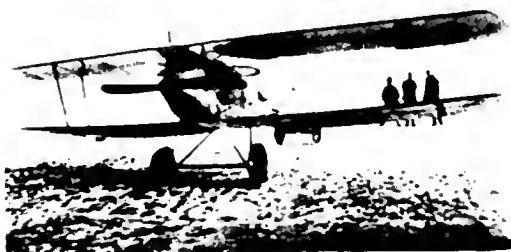
PFALZ SCOUT



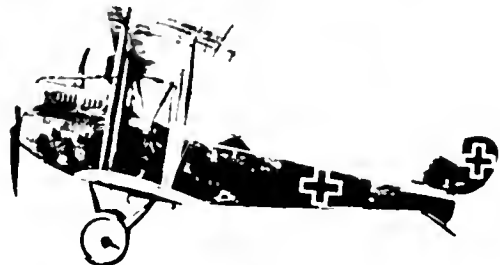
GOtha
BOMBER



RUMPLER



HALBERSTADT



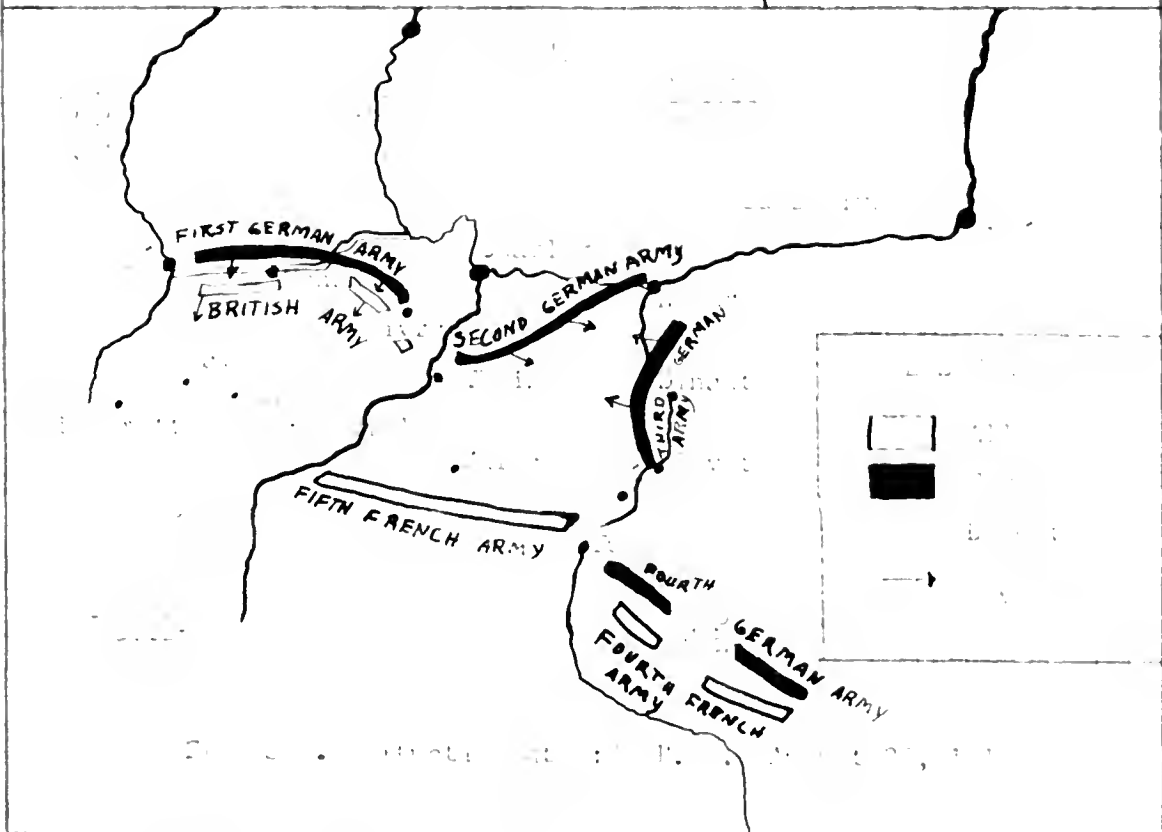
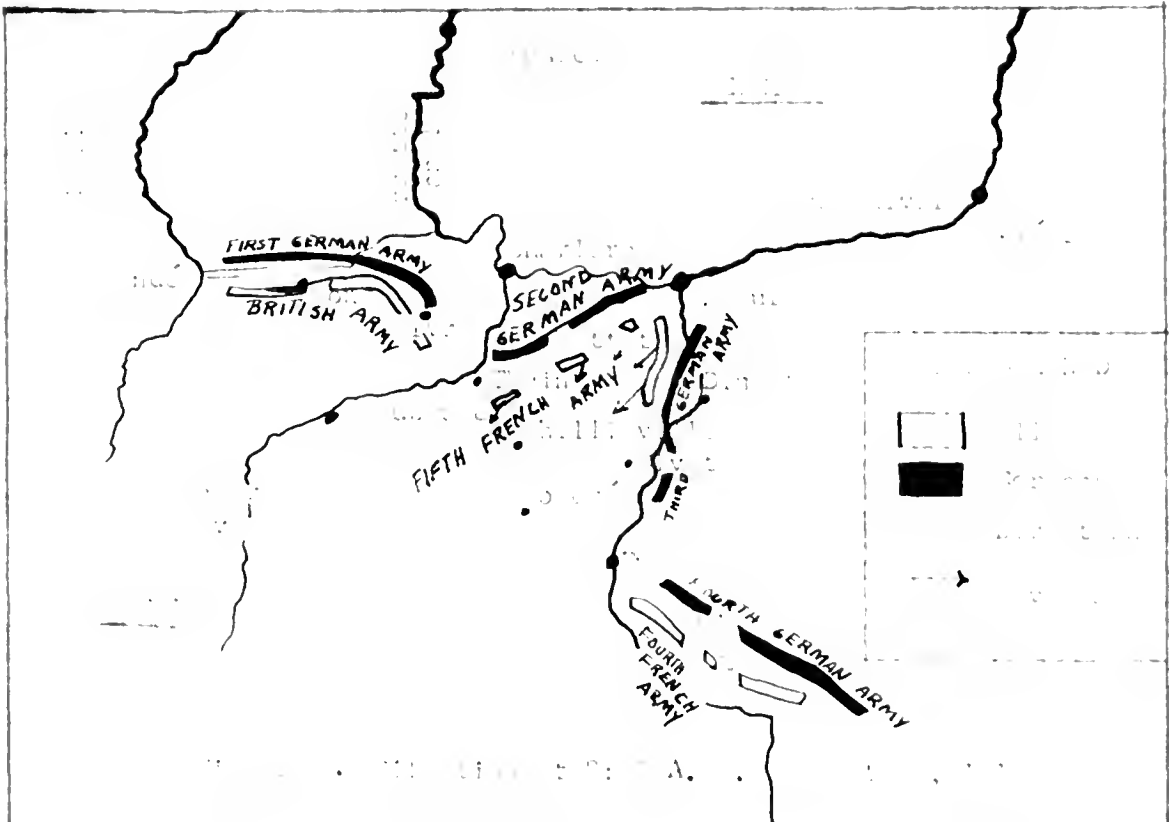
L.V.G.
L.V.G.

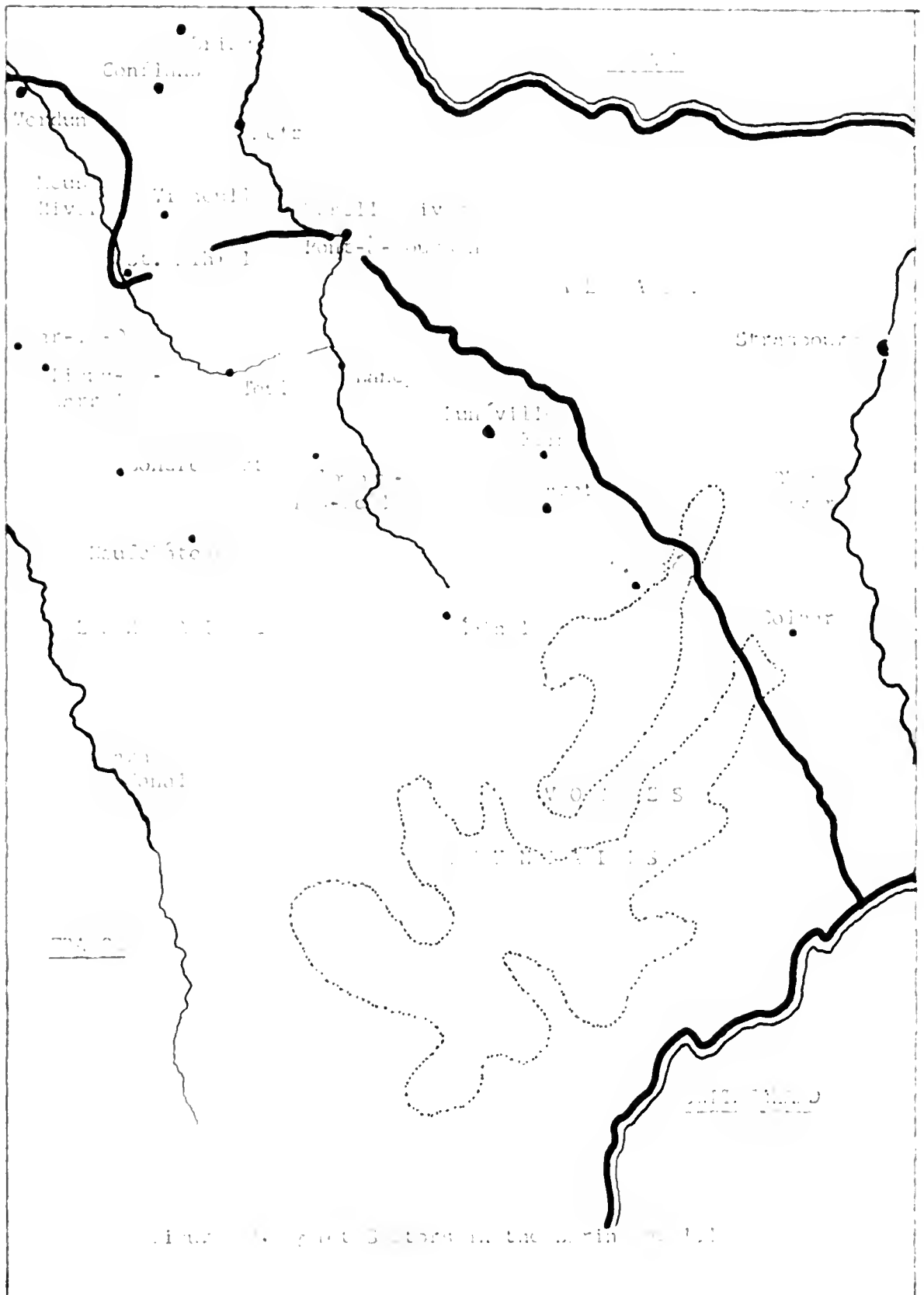
Figure 3. German Aircraft Used in World War I

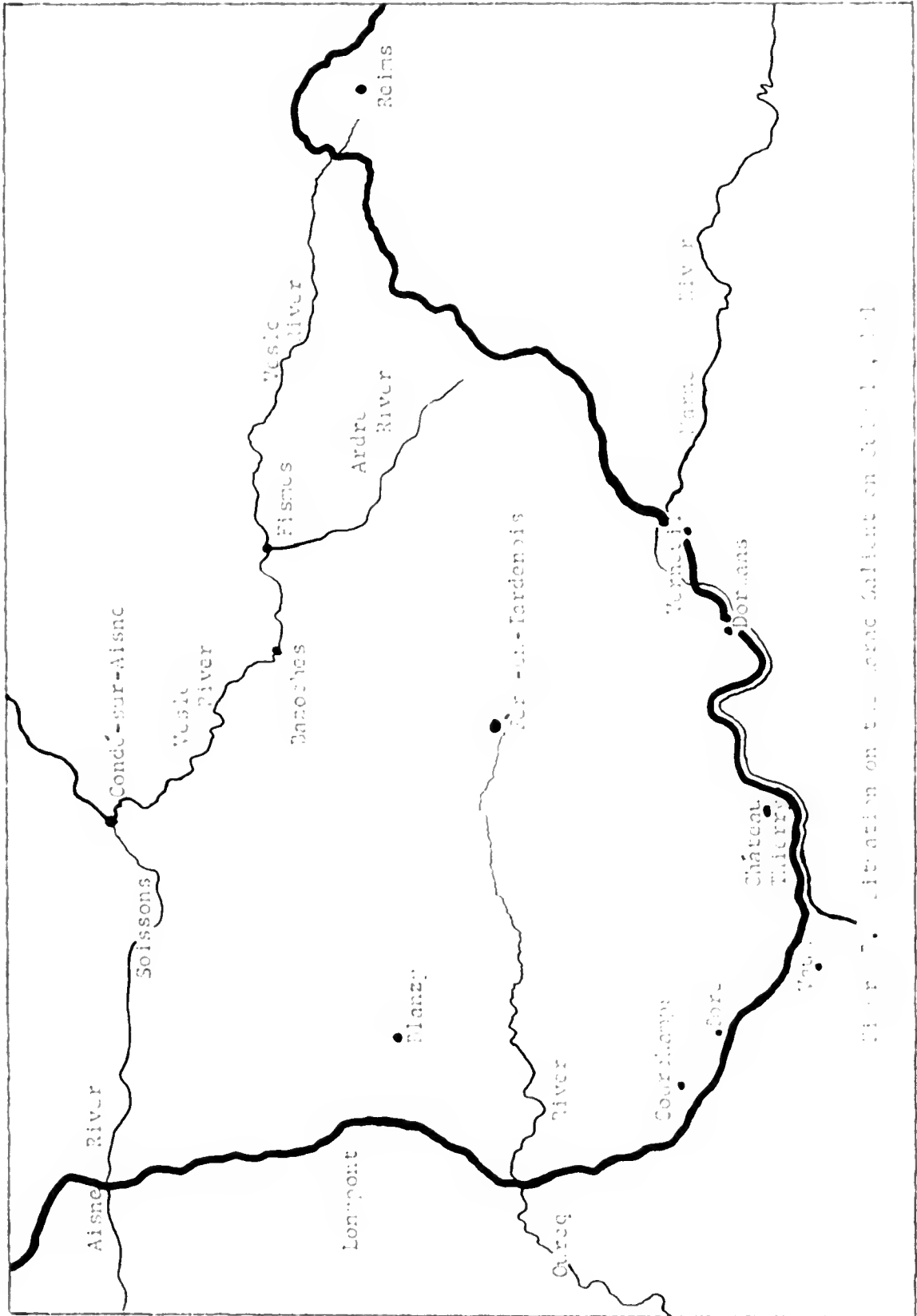
APPENDIX IV

MAPS

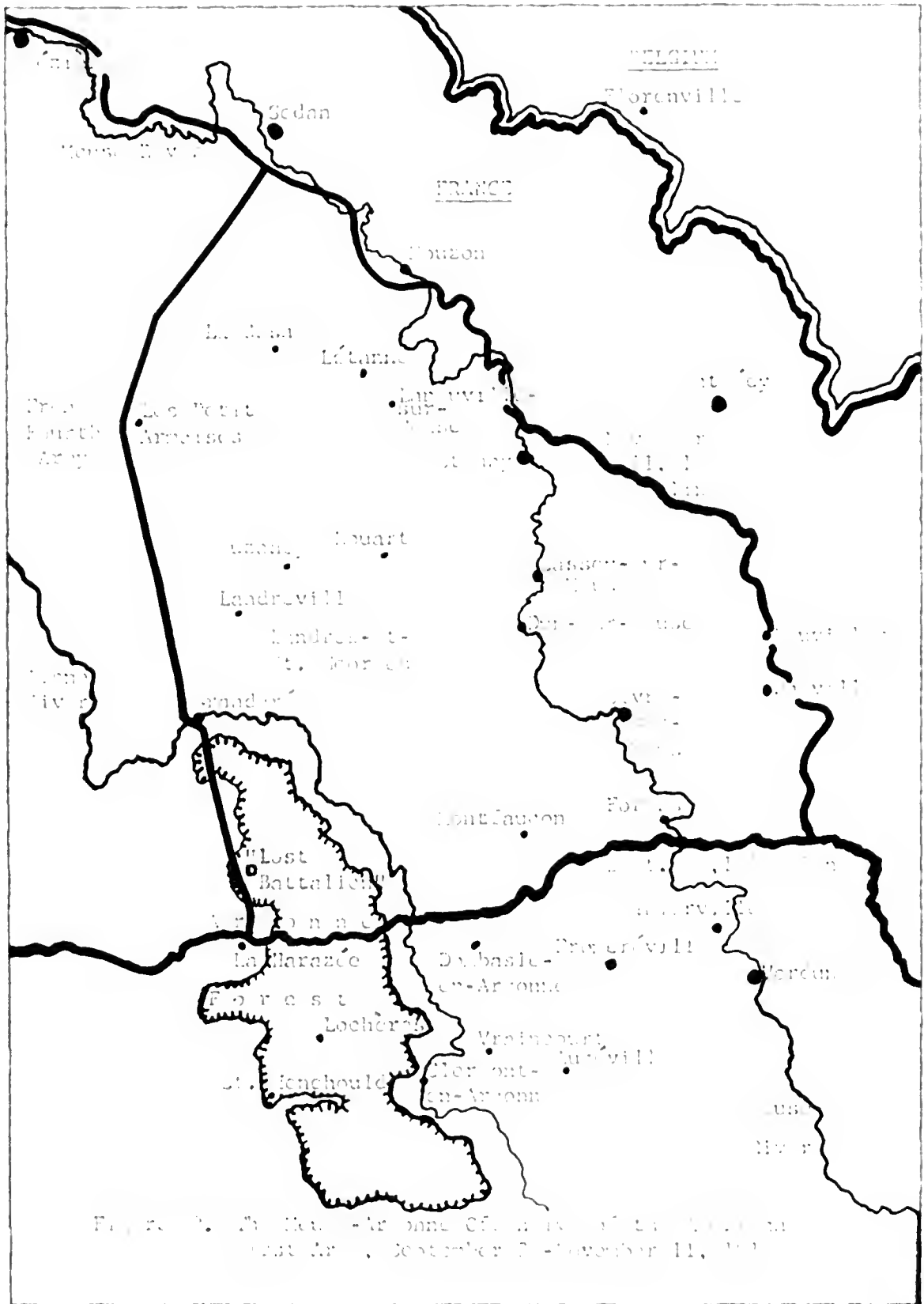
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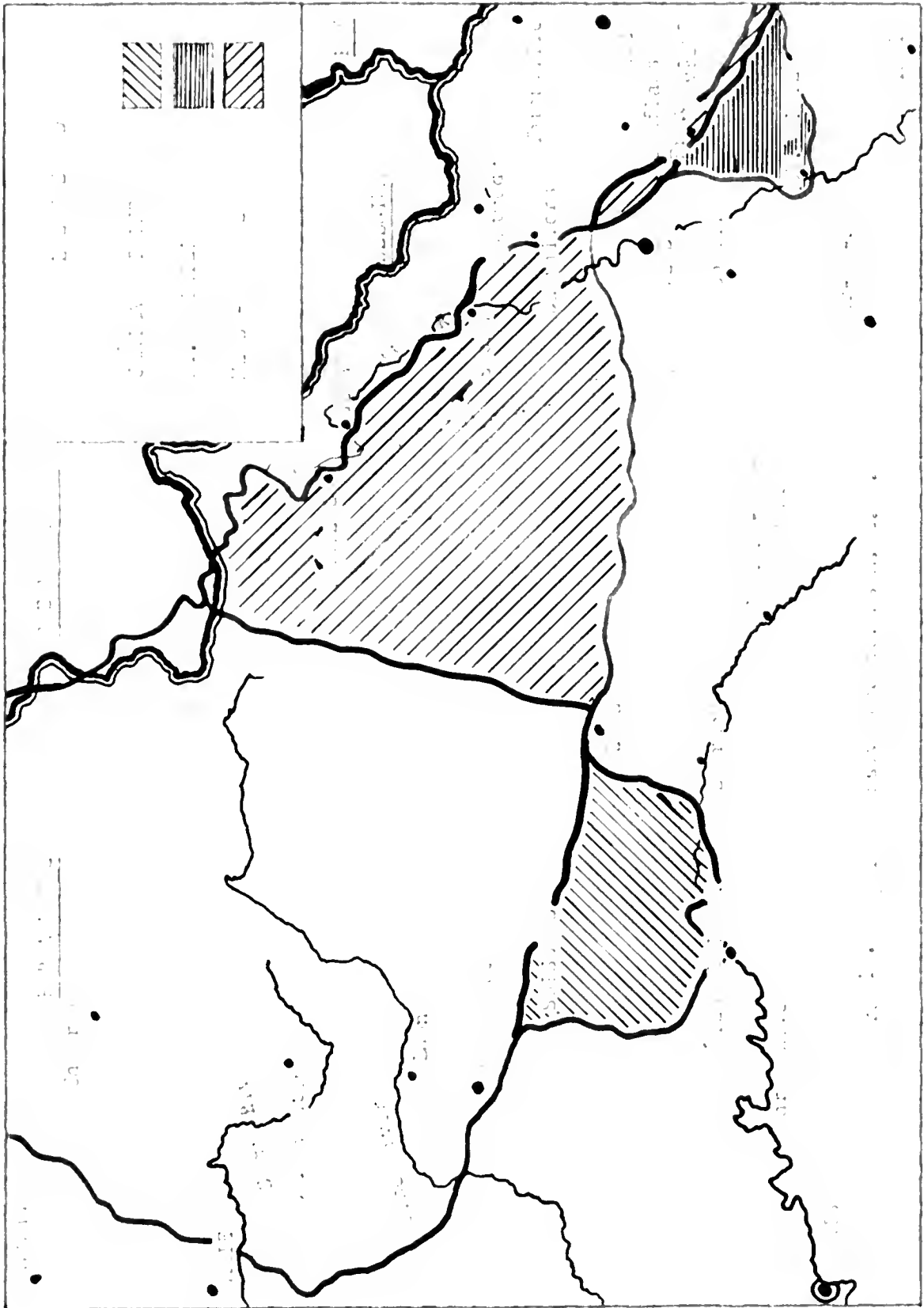












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The holdings of the USAF Historical Division Archives include: Studies prepared by the staff of the Research Studies Institute; papers in the Observation Section of the Department of Air Tactics and Strategy of the Air Corps School (the forerunner of the Air University); collections of leading American aviators such as Lahm and Foulois; and squadron unit histories.

The multivolume history of the Air Service, American Expeditionary Forces, France, 1917-1918, a large collection of letters, plans, memoranda, and reports assembled under the direction of Edgar S. Gorrell, is the most important source in the National Archives. The correspondence files for the Chief Signal Officer from 1916 to 1919 were also investigated.

The Air University Library has an excellent collection of general works and personal accounts of aviation in the First World War (it is far superior to similar holdings in the Library of Congress).

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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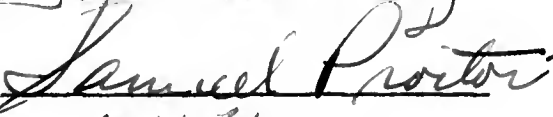

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